Farm Practices Guidelines For

Poultry

Producers In Manitoba

Manitoba Agriculture and Food

FARM PRACTICES GUIDELINES FOR

POULTRY PRODUCERS

IN MANITOBA

Prepared by
The Agricultural Guidelines Development Committee

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The Agricultural Guidelines Development Committee was appointed by the Minister of Agriculture and Food with the mandate to develop guidelines for livestock operations that would form the basis of regulations and functioning of the Farm Practices Protection Board. The guidelines would also be used as a current reference to describe the evolution of modern livestock management practices when reviewing livestock regulations under The Environment Act and in the planning process at the municipal level.

The membership of the Agricultural Guidelines Development Committee is as follows:

Manitoba Agriculture and Food
Keystone Agricultural Producers
Association of Manitoba Municipalities
Consumers' Association of Canada (Manitoba)
University of Manitoba
Manitoba Conservation
Manitoba Intergovernmental Affairs
Manitoba Health
Prairie Farm Rehabilitation Administration

TABLE OF CONTENTS

		Page
Foreword		ii
TABLE OF CONTENTS		iii
LIST OF TABLES		vi
LIST OF APPENDICES		vii
Section 1	**NEED FOR GUIDELINES**	1
1.1	Purpose of the Guidelines	1
1.2	Background	1
1.3	Dealing with Nuisances	1
1.4	Dealing with the Environment	2
Section 2	**ACTS, REGULATIONS AND BYLAWS**	3
2.1	The Farm Practices Protection Act	3
2.2	The Environment Act	4
2.3	Municipal Land Use Issues	5
2.3.1	The Planning Act	5
2.3.1.1	Provincial Land Use Policies	5
2.3.1.2	Development Plan	6
2.3.1.3	Zoning bylaw	6
2.3.1.4	Situation in Manitoba	6
2.3.2	The Municipal Act	7
2.4	The Water Rights Act	7
Section 3	**MANURE HANDLING AND STORAGE**	8
3.1	Solids Content	8
3.2	System Components	8
3.3	Equipment Selection and Maintenance	9
3.3.1	Manure Handling Systems in the Poultry Industry	10
3.3.1.1	Caged Housing	10
3.3.1.2	Floor Housing	11
3.4	Planning a Manure Storage Structure	12
3.4.1	Location	12
3.4.2	Size	13
3.5	Storage Types	13
3.5.1	Storage of Solid and Semi-solid Manure	13
3.5.2	Storage of Liquid Manure	14
3.5.2.1	In-ground Concrete Structures	15
3.5.2.2	Above-Ground Storage Structures	15
3.5.3	Earthen Storage Structures	15
3.6	Composting Manure	16
3.7	Health Concerns Regarding Manure Storage Structures	17
3.8	Safety	18
3.8.1	Precautions when Managing Livestock Manure	18

		Page
Section 4	**LAND APPLICATION OF MANURE**	19
4.1	Manure – A Sustainable Resource	19
4.1.1	Manure as a fertilizer	19
4.1.2	What's in manure?	19
4.1.3	Measuring manure nutrient content	21
4.2	Odour Control	22
4.2.1	Equipment selection	22
	4.2.1.1 Solid manure spreading	22
	4.2.1.2 Liquid manure spreading	23
4.2.2	Manure management stewardship	24
4.2.3	Weather conditions	24
4.3	Prevent Pollution	25
4.3.1	Nitrate leaching and groundwater contamination	25
4.3.2	Sensitive groundwater areas	26
4.3.3	Soil pollution	26
4.3.4	Seasonal considerations	26
4.3.5	Distance to surface water	27
4.3.6	Winter spreading	27
4.4	Application Rate	28
4.4.1	Losses during application	28
4.4.2	Soil and crop implications	29
4.4.3	Acceptable application rate	30
4.4.4	Crop planning and selection	30
	4.4.4.1 Spreading on pastures	30
4.4.5	Manure management plans	31
4.5	Economic Benefits from Sound Manure Management	31
4.6	Health Concerns Regarding Land Application of Manure	33
4.6.1	Nitrates in drinking water	33
Section 5	**ODOUR CONTROL**	34
5.1	Where Odours Come From	34
5.2	Human Response to Odours	34
5.2.1	Other air quality concerns	35
5.3	Sites of Odour Production	35
5.4	Livestock Operation Design	35
5.4.1	Manure management system	36
	5.4.1.1 Egg Production: Liquid systems	36
	5.4.1.2 Broilers: Straw-based litter systems	36
5.4.2	Housing environmental control	37
5.4.3	Landscaping	37
5.4.4	Setbacks from neighbours	37
5.5	Storage Odour Control	37
5.5.1	Storage methods	37
5.5.2	Setbacks	38
5.5.3	Shelterbelts	38
5.6	Odour Control Plan	38

Page

Section 6 SITE SELECTION 39
6.1 Setback from Physical Features 39
6.1.1 Separation between livestock operations 40
6.2 Setbacks and Other Steps to Avoid Nuisance 40
6.2.1 Using the landscape 43
6.2.2 Occasional air drainage 43
6.3 Avoid Direct Contamination of Wells 43
6.4 Environmental Considerations for Siting 43
6.4.1 Siting of the manure storage structures 43
6.4.2 Considerations for land application of livestock manure 44
6.5 Water Resource Availability 44

Section 7 DEAD ANIMAL DISPOSAL 45
7.1 Rendering 45
7.2 Burial 45
7.3 Composting 46
7.4 Incineration 46

Section 8 PREPARING A LIVESTOCK OPERATION PROPOSAL 48
8.1 Public Controversy 48
8.1.1 Thoughts for change 48
8.1.2 Public understanding 49
8.2 Technical Review Process for Intensive Livestock Operation 50
8.2.1 Process of a technical review 50
8.2.2 Public access to the report 50
8.3 Land Base Requirements for Manure Application 50
8.4 Resource Information 53
8.4.1 Manitoba Agriculture and Food 54
8.4.2 Other resources 55
REFERENCES 127

LIST OF TABLES

		Page
TABLE 1	Components of a Manure Handling System for Livestock Production	9
TABLE 2	Required Manure Storage Setbacks from Surface Watercourses, Sinkholes, Spring and Wells	13
TABLE 3	Annual Manure Production	14
TABLE 4	Typical Poultry Manure Nutrient Content	22
TABLE 5	Nutrient Loss, Odour Suppression and Recommended Setbacks for Spreading Livestock Manure with Different Methods	24
TABLE 6	Recommended Distances from Watercourses, Sinkholes, Springs, Wells and Residential Property Lines for Manure Spreading	27
TABLE 7	Required Distance from Watercourses, Sinkholes, Springs, Wells and Residential Property Lines for Manure Spreading Between November 10 and April 15	28
TABLE 8	Loss for Manure Nitrogen During and After Application	29
TABLE 9	General Recommendations for Nitrogen Application Rates	29
TABLE 10	Manure Application Rate Calculation Worksheet	32
TABLE 11	Recommended Setbacks from Property Lines	40
TABLE 12	Recommended Criteria for Siting Livestock Operations	41
TABLE 13	Converting Number of Animals to Animal Units	42
TABLE 14	Nitrogen Storage and Application Factor	52
TABLE 15	Soil and Crop Nitrogen Utilization	52
TABLE 16	Animal Unit Factor	52
TABLE 17	Land Base Required for Manure Application, hectares	53
TABLE 18	Characteristics of the Most Dangerous Manure Gases	93

100-06148/

LIST OF APPENDICES

		Page
APPENDIX A	The Farm Practices Protection Act	56
APPENDIX B	Livestock Manure and Mortalities Management Regulation	64
APPENDIX C	Imperial Units	84
APPENDIX D	Alternative Methods of Manure Treatment and Utilization	94
APPENDIX E	Nitrogen Loss Summary	99
APPENDIX F	Soil Sampling Procedures	100
APPENDIX G	Manure Management Plan Registration Form	105
APPENDIX H	Livestock Production Operation Information Review form	112
APPENDIX I	Development of the Animal Unit	124
APPENDIX J	Manure Production Rates and Characteristics	126

SECTION 1 NEED FOR GUIDELINES

1.1 PURPOSE OF THE GUIDELINES

These guidelines describe manure management systems and practices designed to protect the environment, reduce the risk of pollution[1], and minimize the odours experienced by neighbours.

The objectives of these guidelines are:

- to provide local governments with a basis for evaluation of livestock operations;
- to assist livestock producers in their efforts to prevent pollution and to minimize odour;
- to provide a standard that may be used by the Farm Practices Protection Board in determining normal, acceptable farming practice; and
- to provide information to the general public and government officials who evaluate livestock operations for their potential effects on the surrounding area.

1.2 BACKGROUND

Manitoba's livestock industry has undergone significant changes, both in size and production methods. In the past, poultry production was generally part of a mixed farming operation. Manitoba's poultry products are produced within a supply management system characterized by relatively smaller-sized family production units. All poultry industry sectors however, are experiencing growth in production with some significant increases in production unit size and capital intensity. Steady growth is likely to continue in the future.

In many areas of Manitoba, the character of the rural residential population has changed. For various reasons, people have built or bought houses in and around land that had previously been used for agriculture alone. These rural properties represent a major personal investment, and the owners are sensitive to any activity that may interfere with their enjoyment of the property, or affect the property value. The result of the changes in the livestock industry and in rural residential development has been the creation of a situation where conflicts may occur.

1.3 DEALING WITH NUISANCES

Unwanted odours are a common cause of conflicts between neighbours. The best opportunity for avoiding potential odour problems occurs during land use planning. Ideally, agricultural land should be protected to ensure a full range of agricultural activities, including modern large-scale livestock production.

In Manitoba, land use planning is performed at the local government level. The provisions of The Planning Act in this regard are explained in section 2. Problems occur when municipal jurisdictions are unwilling or unable to prevent residential development in agricultural areas. As well, municipal officials often lack the resources necessary to properly evaluate the relevance of proposed manure management practices relative to the management of odours from livestock operations. As a result, conflicts between rural residents and livestock producers may arise.

While land use planning is one method of avoiding conflict, another process is required to resolve conflicts if they occur. Complaints concerning disturbances such as odour, noise, dust or smoke must be dealt with under The Farm Practices Protection Act. The scope of this Act is presented in section 2.

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[1] Refer to the definition of pollution in the "Livestock Manure and Mortalities Management Regulation," Appendix B.

1.4 DEALING WITH THE ENVIRONMENT

Society is becoming increasingly concerned with environmental protection. Producers who follow the recommended practices described in these guidelines can expect to be in compliance with the relevant provincial regulations. The implications of the Livestock Manure and Mortalities Management Regulation are discussed in section 2.

The viability of the livestock industry is dependent on the sustainability of the environment; therefore the protection of the environment is of major concern to the livestock industry. Water pollution is an environmental and health concern, and is regulated under The Environment Act. Pollution of water and soil resources is illegal. Manitoba Conservation is responsible for preventing pollution, detecting pollution if it has occurred and enforcement of the Livestock Manure and Mortalities Management Regulation.

SECTION 2 ACTS, REGULATIONS AND BYLAWS

Livestock operators should be aware of a number of provincial acts and regulations and local municipal bylaws that could affect the establishment, expansion and/or management of their facilities.

Siting and other land use considerations are more appropriately dealt with through The Planning Act and the consequent bylaws, permitting and planning authorities delegated to local municipalities. Water supply may be affected by The Water Rights Act.

Livestock manure and mortalities management are regulated under The Environment Act, while odour and other nuisance issues are addressed by The Farm Practices Protection Act, as well as municipal bylaws.

2.1 THE FARM PRACTICES PROTECTION ACT

The Farm Practices Protection Act (see Appendix A) was proclaimed on January 31, 1994 to protect farmers who carry on normal farm practices from unreasonable court action under the common law of nuisance. It also protects neighbours against nuisance from unacceptable farm practices. The Act establishes a process for reviewing and mediating nuisance disputes arising from practices of legally established agricultural operations.

The Act provides protection from nuisance claims by specifying that a person who carries on an agricultural operation, and who:

a) uses normal farm practices; and

b) does not violate:

   i) a land use control law;

   ii) The Environment Act or the regulations and orders; or

   iii) The Public Health Act or the regulations and orders,

is not liable in nuisance to any other person for any odour, noise, dust, smoke or other disturbance, and shall not be prevented from carrying on the agricultural operation. In addition, should the land use bylaw of a municipality be amended, or the ownership change, the agricultural operation may continue to operate and be given protection from nuisance complaints.

Normal farm practices are defined as practices conducted in a manner consistent with proper and acceptable customs and standards as established and followed by similar agricultural operations under similar circumstances. This includes the use of innovative technology used with advanced management practices, and in conformity with all provincial legislation.

The Farm Practices Protection Board has been established to consider nuisance complaints against an agricultural operation from persons directly affected by the disturbance. Complainants may not undertake a nuisance action in court unless they have applied to the Board in writing at least 90 days previously for a determination as to whether a farm practice is normal. The Board will consider complaints only about odour, noise, dust, smoke and other such disturbances. It will not deal with pollution issues, erosion problems, inhumane treatment of animals or other non-nuisance items.

The complaint must be in writing and shall state the nature of the disturbance; name and address of the person making the application; and the name and address of the agricultural operation. There is a nominal application fee, which is refundable if the Board upholds the complaint.

Upon receipt of the complaint, the Board may investigate the disturbance, attempt to mediate the complaint, gather evidence, hold hearings and rule on the acceptability of the farming practices relating to the nuisance

complaint. The Board may also refuse to consider the complaint if, in its opinion, the subject matter is trivial, frivolous, vexatious, or the complainant does not have a sufficient personal interest.

The Board shall dismiss the complaint if the disturbance complained of results from a normal farm practice, or order the agricultural operation to either cease or modify the farm practice causing the disturbance. The Act makes provision for the Board to file its orders with the courts and have the orders enforced. Failure to comply with the orders could result in a contempt of court action. The Board's orders may also be used as evidence against an agricultural operation in subsequent court proceedings based on the common law of nuisance.

The Act is intended to provide for a quicker, less expensive and more effective way than lawsuits to resolve complaints about farm practices. It may create an understanding of the nature and circumstances of an agricultural operation, as well as bring about changes to the mutual benefit of all concerned, without the confrontational and unwarranted expense of the courts.

2.2 THE ENVIRONMENT ACT

The Livestock Manure and Mortalities Management Regulation MR 42/98 (see Appendix B), under The Environment Act, strengthens the protection of the environment, enhances enforcement capabilities, and helps to ensure that livestock production will be sustainable in the long term in Manitoba.

Spreading of manure – Land application on fields by large-scale livestock operations, defined as having more than 400 animal units of a given livestock type, is now prohibited from November 10 until April 15. Livestock operations with fewer than 400 animal units of any one type of livestock are exempt unless their manure management practices are causing an environmental concern. Existing producers have until November 10, 2003 to comply with the new measures concerning winter application of manure, whereas new large-scale producers must comply as soon as their operation is established. Emergency situations may warrant exceptions to the prohibition of winter application, upon approval by Manitoba Conservation. Livestock operations that are otherwise exempt from the prohibition of winter application will still have to meet minimum setback distance requirements from sensitive areas such as watercourses, wells, sinkholes and springs.

Application rate - The Regulation sets enforceable limits on the amount of soil nitrates that can be present in the soil at any time. The rate of manure application is to be determined on the basis of nitrogen content in the manure, residual nitrogen concentrations in the soil, soil texture and annual nitrogen requirements for the particular crop on that land.

Manure management plans – Large intensive livestock operations have to prepare and register an annual manure management plan. The manure management plan ensures optimal use of the nutrients in manure and that environmentally sensitive areas can be identified and protected. The manure management plan describes the volume, type (i.e. liquid or solid) and nitrogen content of the manure produced. It also reports how, when and where the manure will be applied. This new requirement for registration of the annual manure management plan came in effect starting January 1, 1999 for new operations and November 10, 1999 for existing operations.

Manure storage structures – Manure has to be stored in appropriate structures. In the case of solid manure, field storage is also acceptable. All structures require a permit from Manitoba Conservation prior to construction. In addition, the structures must be certified by an engineer, before their use or operation, as being constructed according to engineering design standards.

Allowance for innovative practices - Considerable research and innovation is occurring in the field of livestock production

and technological advancements are occurring at a rapid rate. Hence, the requirements of the regulation may be varied where innovative and environmentally sound practices or procedures are proposed.

Mortalities - The Livestock Manure and Mortalities Management Regulation provides for proper disposal of mortalities by rendering, composting, incineration, or burial where environmental conditions are suitable. Mortalities shall be stored in a secure manner and kept either refrigerated or frozen if retained more than 48 hours after death.

Manure spills - Persons transporting livestock manure are required to immediately report the occurrence of a spill or other discharge of livestock manure, as defined in section 9 of the Livestock Manure and Mortalities Management Regulation, where the location or quantities involved may cause an adverse effect on the environment. Minor spills or spills in locations that do not pose a significant threat or risk to the environment do not need to be reported.

Setbacks - Siting requirements which establish the minimum distances (100 m) for which manure storage facilities and composting sites must be set back from surface water courses, sinkholes, wells and springs, continue to offer strong protection for our water resources.

Pollution issues - Other sections of the regulation continue to prohibit the direct contamination of surface and ground waters by livestock manure. Similarly, livestock manure must not be permitted to escape the property boundaries of land where it is either stored or applied as a fertilizer.

2.3 MUNICIPAL LAND USE ISSUES

The ultimate responsibility and authority to regulate land use rest with local governments. Pursuant to The Planning Act or The Municipal Act, a municipality may enact municipal bylaws, development plans and zoning bylaws with the conditional use permitting process to regulate the location, size and operation of livestock production operations.

2.3.1 The Planning Act

The Planning Act is the main mechanism for land use planning at the local government level guided by Provincial Land Use Policies Regulation.

2.3.1.1 PROVINCIAL LAND USE POLICIES

Under The Planning Act, the Province developed and adopted the Provincial Land Use Policies Regulation (184/94) to promote sustainable development and guide provincial and local authorities undertaking or reviewing local land use plans.

The Policies are also used as a benchmark in the review of subdivisions or other developments in areas where a development plan has not been adopted at the local level. Provincial Land Use Policies encompass Development Policies in nine broad policy areas (including Agriculture) and establish separate Subdivision Policies. Considerations with respect to livestock operations are most directly addressed in the General Development and Agriculture Policies sections.

Included in the General Development area are Policy objectives to ensure that development is:

- environmentally sound and consistent with the sustainable use of Manitoba's resources, including the land base, arable soils and water;
- compatible and in harmony with other land uses, and;
- unlikely to result in the creation of dangers and nuisances.

One specific Policy Application statement indicates that non-resource-related uses shall be directed away from prime agricultural land and existing or approved livestock or poultry operations.

With respect to Agriculture, the intent of this Policy is to enhance the stability of and foster economic growth that is environmentally sustainable, by encouraging development, use and management of agricultural lands. This development should occur in a manner that will enhance present and future options for food production and agricultural diversification. The objectives of the Policy are to maintain a viable base of agricultural lands for present and future food production and agricultural diversification, and protect economically viable agricultural operations from encroachment by other land uses that could adversely affect their sustainability.

In applying these policies, it is indicated that land use plans should develop programs and policies that ensure protection for prime agricultural land and agricultural operations and promote economic growth that is environmentally sustainable. Land use plans should provide for the designation of areas in which livestock or poultry operations are permitted to operate without major restrictions on their operation and expansion.

Ultimately, the Provincial Land Use Policies state that criteria related to the establishment or expansion of livestock or poultry operations should be developed by local authorities. Local governments were established as the authority to enact land use regulations covering many land uses, including livestock production operations.

2.3.1.2 DEVELOPMENT PLAN

Broad local land use policies may be enacted by establishing a municipal or planning district developrnent plan in accordance with The Planning Act. Such a plan may establish broad land use categories for the area for such uses as residential, commercial and agricultural, and identify prime agricultural lands and areas where livestock operations may develop. Although not a regulation in itself, the development plan may establish criteria by which livestock operations will be evaluated.

2.3.1.3 ZONING BYLAW

Once a development plan has been approved, a municipality must enact a zoning bylaw that is consistent with its development plan. Such a by-law divides a municipality into various zones such as rural residential, highway-commercial and general agricultural and generally lists specific permitted and/or conditional uses within each zone. There will also be specific requirements pertaining to each permitted or conditional use.

Conditional Use - Livestock operations are generally directed to agricultural zones. Within these zones, livestock operations may be listed as either a permitted and/or a conditional use, the distinction generally depending upon the size of the operation. As a permitted use, a livestock operation has a basic right to be established or expanded and a development permit must be issued provided it meets the requirements established in the bylaw. As a conditional use, an operation may be allowed, subject to it meeting the requirements of the zoning by-law and complying with any other conditions municipal councils deem necessary to ensure the objectives of the development plan and bylaw are adhered to. A conditional use permit may be declined if these objectives cannot be met. Before deciding on a conditional use, municipal council must first serve public notice, notify adjoining land owners and conduct a public meeting as provided for under section 53 of The Planning Act.

The decision of the municipal councils on a conditional use application is final. There is no appeal process.

2.3.1.4 SITUATION IN MANITOBA

As of 1998, over half of the municipalities in Manitoba have adopted development plans and/ or zoning bylaws. A wide variety of requirements and standards for the development of livestock operations have been adopted by these municipalities, ranging from permitting almost all operations to exclusion of large operations. However, in

most municipalities, larger operations and those within a certain distance of residential or urbanized areas are usually deemed conditional uses and therefore subject to the conditional use/public review process.

2.3.2 The Municipal Act

The Municipal Act is limited in its scope in relation to land use controls and is not intended to be used as a long-range alternative to sound land use planning. It may not be used to zone lands for specific purposes and it does not have provisions to restrict other uses of land, such as residential, from locating near a livestock operation.

Where a municipality has no planning document in effect (as described in the previous section), it may use the Municipal Act to enact bylaws to:

- prohibit a development, activity, industry or business until a licence, permit or approval is granted;
- address activities that are or could become a nuisance (including noise, odours, unsightly property).

2.4 THE WATER RIGHTS ACT

A licence may be required under The Water Rights Act to withdraw water from either a surface or below ground source. For agricultural operations, this licence is required when water usage exceeds 25,000 litres per day (5 500 imp. gal/day). At lesser rates of usage, no licence is required.

If a licence is required, an application must be submitted to the Water Licensing Section of Manitoba Conservation, prior to developing the water source. An initial office review of the application is then carried out to determine if the required volume is available from the indicated source and if impacts may result from the development. If water is available for allocation, a Groundwater Exploration Permit (groundwater) or a Preliminary Works Construction Permit (surface water) is issued. The Groundwater Exploration Permit authorizes the construction of wells for extraction of groundwater and the carrying-out of tests to evaluate the availability of water and effects of pumping on nearby wells in the same aquifer. A Preliminary Works Construction Permit authorizes the construction of intakes etc. needed to withdraw water from a surface source. The permits may also require the proponent to undertake additional testing required for a full evaluation of the proposal.

After the terms of the permit has been satisfied, this information is supplied to the Water Licencing Section, which will make a final decision on licensing. If the water supply volume is available and there are no expected adverse effects on other users that cannot be mitigated, a licence is issued. The licence will specify the allowable withdrawal rate and annual withdrawal volume and will also include a requirement for monitoring and reporting of water use.

Many important water sources are at or near full allocation. It is therefore important to submit an application for a water rights licence as soon as possible, as licences have precedence based on the date of application. A project should not be developed without first obtaining a water rights licence, where required.

SECTION 3 MANURE HANDLING AND STORAGE

Livestock manure storage and management are important aspects to consider when planning a livestock operation. Efficient removal of manure from the livestock production facility is necessary for optimum livestock productivity. However, a sound manure management system must also account for the role of manure in the overall operation's sustainability, including the production of crops.

The livestock production practices and manure properties will have a great bearing on the selection of handling equipment. The storage structure type and its operation have implications for the preservation of the valuable plant nutrients contained in the manure or their uniformity when pumped out of the storage.

3.1 SOLIDS CONTENT

The type of equipment used in a manure handling system depends on the solids content. Livestock manure is classified as either a liquid, semi-solid (slurry) or solid, using the following criteria:

- **Liquid** - contains less than 5 per cent solids. The additional liquid comes from washing and spillage from waterers.
- **Semi-Solid** - contains 5 to 25 per cent solids.
- **Solid** - contains a solids content greater than 25 per cent. Poultry manure normally contains approximately 25% solids as excreted.

3.2 SYSTEM COMPONENTS

The elements of a manure management system include collection, transfer, storage, treatment and land application. The components of the system are summarized in Table 1.

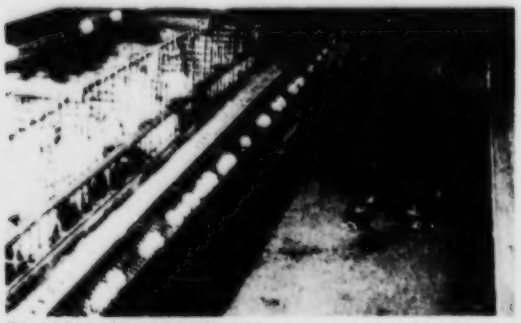
Manure from most types of poultry operations (except for caged egg-layers) is handled and stored as a solid. Chicken and turkey broilers, roasters, and broiler breeder flocks are raised in barns, which utilize straw or wood shavings for bedding. The manure and bedding accumulates in the barn until it is periodically removed when the flock is replaced. Front-end loaders are normally used to remove the manure from the barn and transfer it to the storage area.

Solid manure from a broiler operation

A limited number of poultry operations, such as geese and turkey farms, utilize outdoor ranges. Bird densities on outdoor ranges often vary between 200 to 500 turkeys per acre, or the equivalent for other poultry. Where densities exceed 3,000 turkeys (or equivalent) per acre, the operation would be considered as a confined livestock area. This would be the case for operations using exercise yards adjoining poultry housings. Unless the range is located on very level grounds and with no water-carrying depressions, runoff control measures will have to be provided. The management and

Geese are often raised on open ranges

design of confined livestock areas to prevent pollution from runoff water is discussed in Manitoba Agriculture and Food's fact sheet *Controlling Runoff from Confined Livestock Areas*.



Caged hens for egg production

Caged egg-layer operations and a limited number of breeder barns utilize manure collection and transfer systems that do not involve the use of any bedding material. The manure is therefore in a liquid or semi-solid form, and a variety of collection, transfer and storage systems are used (Table 1).

3.3 EQUIPMENT SELECTION AND MAINTENANCE

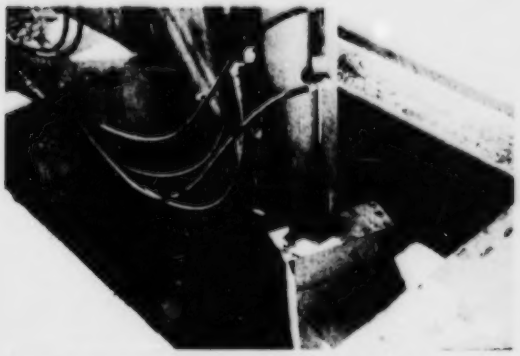
Regardless of the type of manure being handled, it is important to use equipment designed for that purpose and operate and maintain the equipment according to manufacturer's instructions. The equipment must be capable of functioning reliably in a corrosive environment. Equipment also

TABLE 1: COMPONENTS OF A MANURE HANDLING SYSTEM FOR LIVESTOCK PRODUCTION

Operation	Solids	Semi-Solid/Liquids
Collection	Gutter Cleaners Front-End Loaders Belt	Slotted Floors (complete with gutters) Scrapers Cable hydraulic tractor
Transfer	Manure Wagons Open Tank Spreaders Dump Trucks Earth-Moving Equipment	Pumps submerged, open impeller piston pneumatic Augers Vacuum Tank Wagon Pipeline Gravity Continuous-Flow Gutters Large-Diameter Pipes
Storage	Pile Bunk Silo	Glass-Lined Steel Concrete Earthen
Treatment	Aerobic Compost dry incinerate Anaerobic	Aerobic Pre-storage Partial Total Anaerobic Solid/Liquid Separation
Utilize/Disposal	Land Application Energy Production (e.g. biogas)	Land Application Irrigation Energy Production

requires proper maintenance if it is expected to have a long service life. Preventive maintenance and the use of reliable equipment are critical for avoiding problems.

Pumps used in liquid systems require some method of screening out or cutting solid material. Problems can occur when clumps of solids enter the pump. In liquid manure, solids will separate from liquids during storage; therefore agitation is required to bring the solids back into suspension. Chopper pumps are appropriate, since they do not easily become plugged with solids. These agitation pumps have capacities of about 200 L/s (2,600 gal/min).



Pumping out manure from a covered storage tank

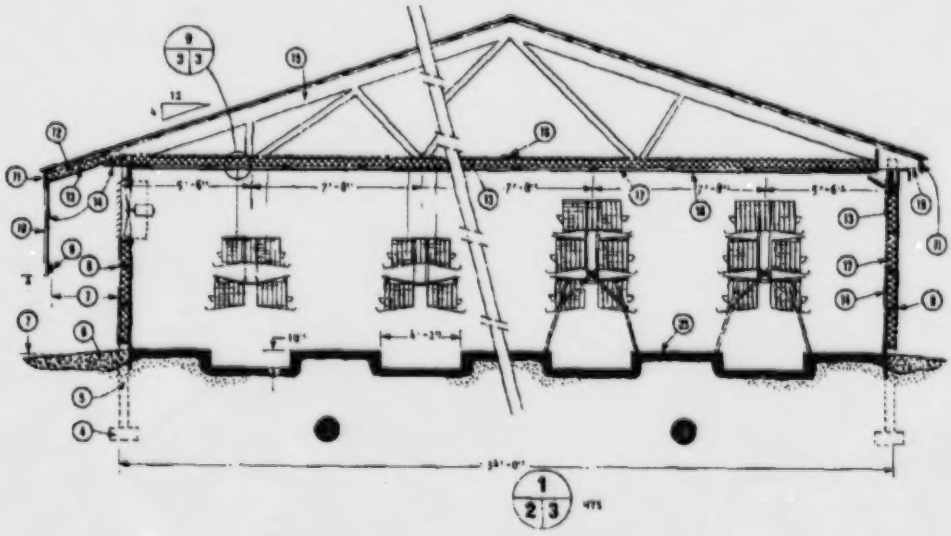
While liquids are transferred by gravity or by pumps, solid manure is transferred by conveyors, augers, piston pumps or front-end loaders.

3.3.1 MANURE HANDLING SYSTEMS IN THE POULTRY INDUSTRY

Many alternative forms of manure management and storage are used by poultry producers in Manitoba. Most poultry manure is handled in a solid, semi-solid or liquid form. For poultry manure to be stored or handled as a liquid, the addition of dilution water to facilitate pumping is required. Drier manure systems, such as deep-pit systems or litter systems on solid floors, minimize fly and odour problems and reduce the volume and weight of manure to be handled.

3.3.1.1 CAGED HOUSING

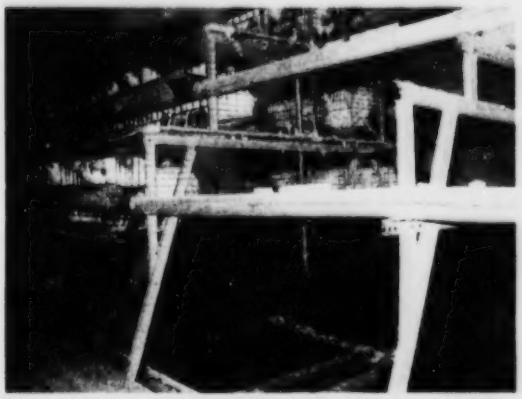
Caged housing is the most common production scenario for the egg-laying producers. As well, pullet producers may raise chickens in cages. Water is usually added to facilitate handling and control odours in most systems.



Schematic diagram of a caged system for poultry, where birds are caged over shallow gutters.

- **Short-term barn storage**

  In the **shallow-pit system**, a shallow gutter 150 to 200 mm (6 to 8 inches) collect the droppings from overhead cages. Manure is allowed to accumulate for a short period and is then removed by a scraper. Other systems utilize belt conveyors under the cages to convey manure to the end of the row.



Battery of cages over a shallow gutter where manure is removed with a scraper

With these systems, there is generally a cross-conveyor (belts, scraper, or auger), which either loads the manure for transport or transfers it to a storage structure for application at a later time.

Some barns have a deeper gutter (0.2 to 2.5 m; 8 inches to 8 feet) designed to store manure from 2 weeks to 2 months.

- **Long-term, in-barn storage**.

  In a **deep pit system**, manure is allowed to drop into a 0.6 to 2.5 m (2' to 8') deep pit under the cages. This provides long-term storage (1 to 3 yr), depending on the depth of the pit. Separate manure storage is not required if manure cleanout coincides with the time of year when the manure can be applied to the land. This system requires access by a front-end loader so manure can be loaded onto a conventional spreader for application. The colder climate in Manitoba complicates drying into pits, explaining their low popularity in the industry.

3.3.1.2 FLOOR HOUSING

Broiler chickens, grower and breeder turkeys, broiler breeder pullets and some commercial egg-laying pullets are raised on floor litter systems. Cleaned floors are covered with fresh litter material prior to housing each new flock of birds. Litter material can be any clean, absorbent, dry material, such as straw wood shavings, sawdust or shredded paper products. Litter is generally spread to a depth of 40 to 150 mm (1 ½ to 6 inches) on concrete floors. Earthen floors of a well-compacted clay base origin may be used, but are not recommended. A greater depth of litter on earthen floor barns ensures liquids are absorbed into the litter. For earth floors, material should be of well-compacted clay base origin. Gravelly and sandy soils should be avoided.

Broiler chicken and turkeys are most commonly raised on solid litter

Both concrete or earthen floor barns should have at least a 300 mm (12 inch) side-wall curb to protect the bottom of the wall from moisture and damage by cleaning equipment.

Broiler breeders are raised on a variation of the above description of floor housing, to accommodate nesting equipment. Feed,

water and nesting equipment are usually placed on a slatted area, constructed directly over a litter layer prepared as for broiler operations. The slatted area may occupy two-thirds of the floor area, with the remaining area left as roaming space for the birds. Most typically, the slatted area consists of plastic slats fastened to a light wood structure providing some 500 mm (20 in.) of clearance over the litter floor. The area under the slats, where most of the manure collects, is inaccessible to birds.

Broiler breeder operations use a combination of floor housing and nesting system for production.

Separate manure storage is not required if manure cleanout coincides with the time of year when manure can be applied to the land.

3.4 PLANNING A MANURE STORAGE STRUCTURE

Manure storage structures must provide flexibility for timing manure spreading, be sufficiently impervious to prevent leakage and provide an appropriate level of odour control. The design of the storage will depend upon the location, the size required, the characteristics of the manure and the methods of filling and emptying. Although some design considerations are discussed, producers are advised to contact an agricultural engineer for complete design information.

Manitoba's Livestock Manure and Mortalities Management Regulation 42/98 (Appendix B) specifies that the construction, modification or expansion of any manure storage requires a permit from Manitoba Conservation.

A professional engineer must do all investigation, design, construction supervision and final certification. Schedule A of the regulation (see Appendix B) specifies minimum siting and construction requirements for earthen storage structures, which were designed to protect surface water, groundwater and soil, as well as provide for consistent construction practices throughout the province. Contact Manitoba Conservation or your regional agricultural engineers with Manitoba Agriculture and Food for further information on earthen storage design and siting criteria, and regulatory requirements.

3.4.1 Location

The storage should be located close enough to the barns to allow for convenient filling and still permit expansion of the facilities. It should be accessible by an all-weather road for field spreading equipment. Its location should also account for the recommended separation distances from neighbours and residential areas (see section 6.2).

The storage should be located to avoid collecting surface runoff. Do not construct manure storage structures on the banks of rivers or drainage channels, or depressions that may carry surface runoff. Provide a grassed buffer strip to intercept manure, which could enter a watercourse if a storage structure leaks or overflows. In order to minimize any risk of polluting, the Livestock Manure and Mortalities Management Regulation requires all manure storage structures to meet the minimum setback distances in Table 2.

The groundwater and soil conditions should be evaluated to ensure that the site is suitable for the type of storage planned (see section 6.4.1). For example, where the groundwater levels are near the bottom of the storage, an earthen storage structure should not be used without a suitable liner. Refer to the following section 3.5.1 for further information on the

TABLE 2: REQUIRED MANURE STORAGE SETBACKS FROM SURFACE WATERCOURSES, SINKHOLES, SPRING AND WELLS[1]

Storage Type	Distance (m) to[2]	
	Watercourse	Source of Domestic Water
All manure storage structures	100	100
Field Storage	100	100
Composting	100	100

[1] Refer to Appendix B, Livestock Manure and Mortality Management Regulation.

[2] See Appendix C for imperial units.

construction requirements of earthen manure storage structures.

3.4.2 Size

The volume of manure produced must be determined in order to calculate storage requirements. Depending on management practices and facilities, the volume of manure to be stored varies from one operation to another. Volume can also vary due to water spillage or from washing.

Accurate estimates of manure production rates are important when an expensive storage system is used, such as covered or open concrete or steel structures. To estimate storage requirements, evaluate an existing operation that is similar to the planned facility. Alternatively, contact one of the resource professionals listed in section 8.4, Resource Information, for assistance, or use Table 3 for guidance.

The storage should have some reserve capacity to allow for the accumulation of solids and for precipitation. When the storage is ready for cleanout, it must have enough capacity to handle a major rainstorm without overflowing. Provide enough storage to allow flexibility to spread manure when field conditions, labour availability, weather and local regulations permit. Short-term storage may require more management and labour, since the time required for setting up and putting away equipment is increased. More importantly, bad weather, labour shortages and equipment breakdowns can seriously disrupt the timing of this seasonal operation. A minimum capacity for 200 days of storage is recommended to provide sufficient manure storage over winter months.

3.5 STORAGE TYPES

In Manitoba, poultry producers rely on floor housing for raising broilers, turkeys, broiler breeders and pullets. They generate solid manure combined with litter. Broiler breeders collect manure under the slatted portion of the barn, which is removed with the littered area. Most commonly, the solid manure and litter mixture is removed after each flock and is stored outdoors until timing is suitable for spreading.

The majority of Manitoba egg producers will use either liquid or semi-liquid manure handling systems. Most operations will usually store this type of manure in outdoor concrete or steel structures. Earthen manure storage structures remain adequate alternatives.

3.5.1 Storage of solid and semi-solid manure

Solid manure containing larger amounts of bedding is normally stored in piles. Storage sites for solid manure must be chosen so as to contain seepage, or else improved accordingly. On coarse granular material such as gravel or sand, for example, an impervious slab (e.g. compacted clay, concrete or asphalt) may be required under the pile. In some situations, it may be necessary to provide a perimeter curb to contain the liquid runoff. Owing to low moisture contents

TABLE 3: ANNUAL MANURE PRODUCTION

Poultry Type	Number of Flocks per Year	Housing System	Annual Production per Bird Space	
			kg/year	m^3/year
Chicken:				
Broilers	6	Floor[2]	10.4	0.035
Roasters	5	Floor[2]	10.4	0.033
Layers	1	Cage[1]	66.0	0.066
		Floor[3]	19.8	0.048
Pullets	2	Cage[1]	20.0	0.020
		Floor[2]	6.8	0.021
Broiler Breeder Pullets	2	Floor[2]	8.8	0.028
Broiler Breeder Hens	1	Floor[3]	26.0	0.066
Turkey:				
Broilers	3	Floor[2]	25.0	0.080
Heavy Toms	2	Floor[2]	50.0	0.158
Heavy Hens	2	Floor[2]	30.0	0.094

[1] Manure removed from barn at 90% moisture content with a density of 950kg/m^3.

[2] 50 mm wood shavings or 100 mm of straw placed on floor. Manure and litter removed from barn at 25% moisture content, with a density of 320 kg/m^3.

[3] One-third litter floor, two-thirds slatted floor. Manure and litter removed from barn at 40% moisture content, with a density of 400 kg/m^3.

[4] See Appendix C for imperial units.

(approximately 25%), solid manure from broiler operations is unlikely to allow for leaching over short periods of time.

In the case of semi-liquid manure, a storage structure consisting of earthen dykes in combination with a 600 mm to 1,200 mm (2 to 4 ft) reinforced concrete wall may be used to contain both the wet manure and liquid runoff. A concrete slab may also be required, depending on soil conditions, to prevent seepage. By sloping the slab or floor to one corner opposite the entrance ramp, the liquid runoff can be collected for removal by vacuum tanker or transferred to a separate storage.

A front-end loader is normally used for emptying. A ramp entrance is ideal for access by a front-end loader and other removal equipment. A concrete bucking wall should be provided to assist in filling the bucket. Provide access for unloading and haul-out equipment. To minimize the volume of liquids to be handled, ensure that the storage is designed to divert outside runoff water away.

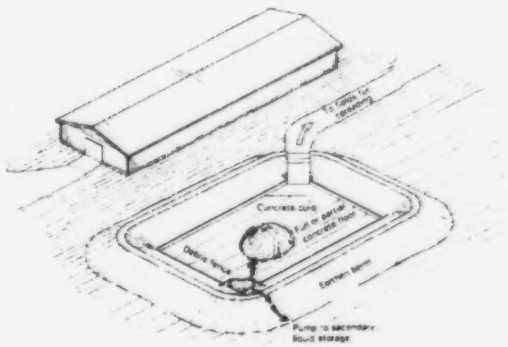


Illustration of a berm around a solid manure pile for runoff control

3.5.2 Storage of liquid manure

Poultry manure is sometimes stored as a liquid by adding dilution water to facilitate pumping, as is the case for egg production. Concrete tanks below ground, earthen storage structures, and concrete or steel

tanks above ground are suitable for storing liquid poultry manure.

When planning a concrete or steel storage, consider how the manure is to be agitated. Provide enough access ports for the pump if the structure is to be covered.

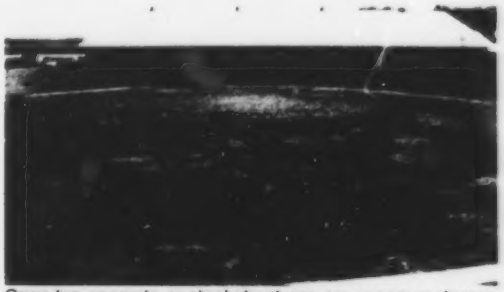
3.5.2.1 IN-GROUND CONCRETE STRUCTURES

A covered concrete manure storage will not generally release odours except when it is emptied. As well, loss of nutrients is reduced when the storage is covered. See Appendix E for a comparison of losses from different systems. Underground concrete structures require proper design to withstand all earth, hydrostatic and live loads.

Covered manure storage is often almost completely underground

3.5.2.2 ABOVE-GROUND STORAGE STRUCTURES

Partially buried and above-ground structures are typically of the circular silo type with an open top. In smaller sizes these structures are similar in cost to underground, covered concrete structures. However, as the above-ground storage becomes larger, the cost per unit volume decreases. Above-ground structures may be the only choice in conditions where space is limited or where soil conditions do not permit the use of an earthen storage structure. The storage may be constructed from pre-cast concrete panels, reinforced cast-in-place concrete, glass-lined steel panels or spiral-wound coated steel. Some structures are equipped with filling and agitation equipment designed specifically for that purpose. The small surface area may permit the formation of a crust on the top, which would considerably reduce odour production.



Open top concrete or steel structures are common storage alternatives for liquid or semi-liquid manure

3.5.3 Earthen storage structures

Earthen storage structures may be used for storing liquid manure. So far, this type of structure is not common in the poultry industry in Manitoba. The advantage of earthen manure storage structures is their low capital cost. The disadvantages are greater surfaces for odour emissions, nutrient loss and the maintenance requirements. Refer to section 6, Site Selection and Appendix B, Livestock Manure and Mortalities Management Regulation, for additional specifications on site suitability.

Earthen manure storage structures should be constructed to be compatible with equipment used for emptying, agitating and maintaining the slopes. Provide a berm width of at least

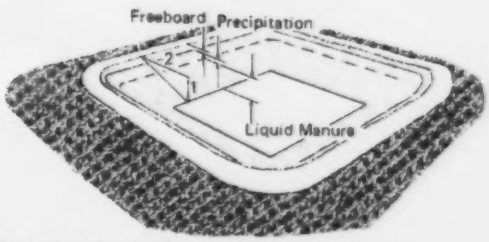


Illustration of an earthen manure storage structure

Final stage of the construction of an earthen storage: compaction with a sheepsfoot packer

2.4 m to allow access for tractors and pumps. Inside slopes should be between 1:2 and 1:4. Outside slopes should be 1:5, to allow easy access with the pumping equipment and for maintenance.

Most earthen storage structures designed with useable volumes under 10 000 m^3 (under 350 000 cubic feet or 2 million imperial gallons) often make up a **single storage cell**. Depending on the size of the storage, multiple pumping stations may be required. Typically, the pump will have to be repositioned at every 30 m around the perimeter of the storage to thoroughly suspend the settled solids and clean the storage bottom. Each of these pumping stations must feature an access ramp and a pumping pad made of rip-rap or concrete. Large earthen manure storage structures may comprise two cells, to facilitate management of the solids.

The Livestock Manure and Mortality Management Regulation prescribes strict design and construction requirements for earthen manure storage structures. Construction requirements are specified for earthen storage structures that are to be built in areas where good clay, or clay-till type material exists (see Appendix B).

3.6 COMPOSTING MANURE

Composting is a biological process in which micro-organisms aerobically convert organic materials into a soil-like material called compost. During composting, the micro-organisms consume oxygen while feeding on the organic matter. They also generate heat and large quantities of carbon dioxide and water vapour. The rate at which manure will compost depends on the oxygen available, size of the manure particles and relative quantities of carbon and nitrogen available to the micro-organisms for use as food. Since the optimum solids content for composting is between 50 and 60 per cent, it is necessary to increase the solids content of liquid waste to at least 35 per cent before it can be composted. Fresh manure can be screened and the resulting solids, which are about 35 per cent moisture, are composted directly. The liquid portion is collected and goes to storage. It is also possible to add some form of bulking agent, such as straw or sawdust, to adjust the moisture content before beginning composting. During the composting process, the volume of waste will be reduced by up to 50 per cent.

In order to provide the conditions for composting, it is necessary to ensure an adequate supply of oxygen throughout the pile. To achieve this, maintain the pile at 40 to 50 per cent solids and mix the material on a regular basis. This process can be carried out using a windrow system, aerated static piles or an in-vessel system. The windrow method consists of placing the mixture of raw

Turning windrows with a bucket loader

materials in long narrow rows (typically 1.0 to 1.2 m high and 3.0 to 3.6 m wide). The windrows are then turned on a fixed schedule to increase aeration and rebuild the bed porosity. Aerated static piles are aerated directly with forced air systems to speed up

the process. The in-vessel system confines the composting material within a building or container and uses forced aeration and mechanical turning to speed up the composting process.

Windrow composting generally takes from one to four months, depending on the frequency of turning. In-vessel composting or aerated static piles requires from two to four weeks. When managed properly, the composting process is aerobic and the release of odours should be minimal – the product will have an earthy odour. If the conditions are not controlled and the manure begins to decompose anaerobically, the compost produces very strong, offensive odours and the process can take much longer.

3.7 HEALTH CONCERNS REGARDING MANURE STORAGE STRUCTURES

All livestock, as well as pets and wildlife, may carry infectious diseases that can be transmitted between animals and humans (zoonotic diseases) under special circumstances. There are three main types of microorganisms to consider: bacteria, viruses and protozoa. Infection can occur through direct contact with an animal, through contact with animal manure or through ingestion of water contaminated with manure. As with all illnesses, prevention is preferable to treatment. The key ways to prevent illness from occurring are:

- maintain good personal hygiene (hand washing is important!);
- select the site for a livestock operation according to the considerations specified in section 6 (Site Selection);
- handle, store and apply manure according to the guidelines presented herein;
- avoid water pollution by adhering to environmental regulations.

Proper siting and construction of manure storage structures is critical to prevent contamination of sensitive groundwater areas and nearby surface watercourses.

Bacteria are common in all animal feces, and are capable of surviving a long time in both stored and applied manure, as well as in soil and water. Some of the bacteria species that may be present in livestock manure are Salmonella, Campylobacter and E Coli, sometimes Clostridium, Leptospira, and Listeria. Coxiella, Yersinia and Brucella are mentioned in the literature but have not been found in Manitoba in poultry.

Viruses that are found in animals don't usually cause human disease. Also, viruses don't survive well outside a host, and are very sensitive to environmental conditions such as temperature and moisture. The bacteria that are present in manure tend to inactivate most viruses.

Protozoa are "emerging pathogens," which means they are being found more frequently than in the past. They are a particular risk for persons with weakened immune systems. Protozoa tend to contaminate surface water supplies, and can cause significant and widespread human illness if present in drinking water sources. These organisms have environmentally resistant forms (cysts) that are resistant to inactivation by conventional water treatment. The zoonotic protozoa of concern are: Giardia lamblia ("beaver fever") and Cryptosporidium parvum ("crypto"). Because these organisms are also shed by wildlife, livestock, pets and humans, the source of contamination is often difficult to determine.

Other parasites, such as nematodes and roundworms, may be present in livestock manure and warrant mention. However in most cases, the animal species of these parasites do not cause diseases in humans.

When these Farm Practices Guidelines are followed, there is little or no threat to public health from manure handling operations or manure storage structures.

3.8 SAFETY

Producers should exercise good farm precautions around livestock manure structures and equipment. Hence, additional precautions are warranted to limit access to manure storage structure and when managing livestock manure. Protect openings with grills or covers and enclose open tanks with a fence to prevent accidental entry into the pit. Consider installing a fence around the storage for safety purposes, and a visible warning to children and unaware visitors. Although the crusted surface of manure storage structure may appear solid, it will not support a person.

3.8.1 Precautions when managing livestock manure

As manure decomposes, gases are released. The types of gases produced depend upon how the manure is stored. Under aerobic conditions (with oxygen present) the gases produced are not dangerous. However, when manure is stored anaerobically (no oxygen present), some of the gases produced are dangerous. When liquid manure is stored for a period of several weeks in an enclosed space, the dangerous gases can accumulate in the head space of the tank and in bubbles and dissolved gases within the manure itself. The greatest danger occurs when the manure is agitated. During this operation, the gases held in the manure are released and the concentrations can reach lethal levels within minutes. Several deaths have occurred as a result of farm workers entering manure structures.

The publication M-8710 *Manure Gas* from Canada Plan Service discusses the sources and types of gases of concerns. This leaflet is available from your Manitoba Agriculture and Food regional engineer. **The gas that is most dangerous is hydrogen sulphide**. Although it is readily detectable at low concentrations, at higher levels the gas paralyses the sense of smell. **So it is possible to unknowingly encounter a dangerous situation**. As the concentration increases, the hydrogen sulphide paralyses the nerves that control the diaphragm, causing a person to stop breathing. **When concentrations are high, a single breath of the gas can be fatal**. The other gases and their respective level considered to be dangerous are listed in Appendix C (Table 18).

Good design and safe habits can prevent accidents from happening. Long-term storage should not be in the same air space as the animals or workers. The agitation required to remove the manure from the barn can increase gas concentrations to lethal levels very rapidly. Connections between the barn and long-term storage must be separated by a gas trap to prevent the gases from returning to the barn. Design the facility so that all servicing can be performed without entering the storage.

When agitating manure in an in-barn storage, be certain to provide maximum ventilation. All personnel should work in pairs. All people should be evacuated from the air space above the storage, and animals should be evacuated if possible. Begin by pumping without agitation to create several feet of head space for the gases. Agitate below the surface and do no more agitation than is necessary.

Never enter a manure tank without proper respiratory equipment that is designed for the purpose. A breathing apparatus specifically built for this purpose, comprising a full-face mask and remote air tank and hose, is required. SCUBA equipment is not adequate. Always work in pairs. If an accident does occur, apply cardio-pulmonary resuscitation (CPR).

SECTION 4 LAND APPLICATION OF MANURE

4.1 MANURE - A SUSTAINABLE RESOURCE

Applying manure to land is a highly desirable method of recycling a natural fertilizer produced by livestock. The application of livestock manure to land is a sustainable agricultural practice. Manure may serve as a viable substitute for commercial, inorganic fertilizer because of its on-farm availability and ability to enhance the organic matter content of soil. Through the addition of organic matter, manure not only acts as a source of plant nutrients, but also helps to improve soil tilth, structure, aeration and water holding capacity.

Most livestock operations are based on, or surrounded by, large areas of productive agricultural land. Despite some of the negative perceptions pertaining to manure application, the reality is that manure is an excellent fertilizer. To prevent damage to crops, minimize the risk of pollution and obtain the maximum benefit of the manure as a fertilizer, manure application rates should match the crop nutrient requirements.

The goals sought when using livestock manure as a fertilizer should be to:

- maximize the utilization of the manure nutrients by crops;
- minimize the risk of polluting surface water and groundwater.

4.1.1 Manure as a fertilizer

Manure is made up of several nutrients needed for crop production. A large portion of these nutrients is readily available to growing crop, while another portion gradually becomes available over time. Regardless of which portion the nutrients from manure are in, it is important to note that the crop does not distinguish between source of nutrients. The

Recycling of livestock manure is a sustainable practice

crop will take up, process and utilize the nutrients in manure the same way it uses nutrients from commercial fertilizer or from the soil. Proper management is needed to ensure that an adequate balance of nutrients is made available to the growing crop at the appropriate times to maximize nutrient utilization, as well as crop yield and crop quality.

4.1.2 What's in manure?

Although poultry are relatively efficient in converting feed to body tissue, a large share of the nutrients in the feed is not used by the birds and is excreted in the feces. Therefore, the nutrient content of manure is directly affected by the nutrient content of the poultry feed.

The composition of the manure can be influenced by the following factors:

Animal age - manure constituents are the feed products remaining after digestion by birds. As poultry grow, their ability to convert the nutrients in the feed to body tissue changes.

Feed type – invariably, there is always a fraction of the feed that cannot be digested; the undigested nutrients will be excreted in the manure. Unless a ration is balanced, excessive quantities of nutrients will be excreted. Multi-phase feeding management attempts to more accurately match the nitrogen and phosphorus levels of the feed to the animal requirements at each stage of the animal's growth. An advantage of this procedure is to minimize the amount of nitrogen and phosphorus excreted by the animal.

Storage and handling – the manure handling system (e.g. liquid vs. solid) and storage type and duration also have an impact on the nutrient content of manure. In addition, the amount of nutrient effectively available to plants depends on the equipment selected to field apply manure, the timing of the application and post application field operations such as tillage. Nitrogen is the nutrient that is most affected by the various components of manure management systems.

- Nitrogen

A typical manure analysis contains three categories for nitrogen content:

- Total Nitrogen
- Ammonia (or Ammonium) Nitrogen
- Organic Nitrogen

As the term suggests, total nitrogen is an expression of all of the nitrogen contained in the manure. Not all of this nitrogen will be available to the crop in the year of application.

Ammonia is the nitrogen form that is available to the crop. This is the same form of nitrogen that makes up anhydrous ammonia (82-0-0). The actual amount of ammonia available to the crop is calculated by subtracting volatilization losses during application from the amount of ammonia in the manure.

Organic nitrogen is calculated by taking the difference between total nitrogen and ammonia. This form of nitrogen is slowly released to the crop and can have a significant impact in the nitrogen-supplying power of the soil if allowed to build up after several years of repeated manure applications. About 25 to 30 per cent of the organic nitrogen is mineralized and available to the crop in the first year, with the remainder becoming available during the next three years at a decreasing rate.

- Phosphorus

Phosphorus is usually found in manure in smaller quantities than nitrogen. However the amount present relative to crop production requirements is higher than nitrogen in some cases. That is, if manure is applied at rates to satisfy crop nitrogen requirements, then a surplus amount of phosphorus may have been applied. The use of phytase in the feed ration is an effective way to reduce this imbalance. Elevated levels of phosphorus in surface water may result from runoff over manure left at the soil surface, which would promote algae blooms that adversely affect water quality. However, the following factors should be considered:

- most of Manitoba's soils are very deficient in phosphorus and can benefit from a buildup in phosphorus;
- approximately 50 per cent of the phosphorus in manure is immediately available;
- a portion of the inorganic form is tied up in calcareous (high-pH) soils;
- manure that is incorporated or injected is protected from runoff;
- observing recommended setbacks for watercourses minimizes the potential for runoff and entry into surface water.

- Organic Matter (carbon)

The application of manure to cropland can help to maintain soil organic matter levels, improve soil tilth and control soil erosion. When the soil is tilled and fields are cropped, a portion of the organic matter is oxidized and lost from the field. The use of commercial inorganic fertilizers does not replenish the lost

organic material. Depending on soil type, a steady depletion of soil organic matter can result in a soil structure that is more susceptible to erosion and crusting. Application of manure will improve the soil condition and water-holding characteristics as a result of the regular addition of organic matter.

- Potassium

Most Manitoba soils, except for sandy soils, have naturally high levels of potassium. Therefore, the addition of potassium to soils through manure applications is a small benefit to crop production. If manure application occurs in instances where high levels of potassium are of concern, such as forage crop quality and dairy cow performance, then soil and plant tissue tests should be part of a regular monitoring program.

- Sulphur

Sulphur levels in manure are generally low, usually between 0.1 to 0.4 kg/m^3 (1 m^3 is equal to 1,000 L; 1 to 4 lb/1,000 gal). The availability of the sulphur in manure is variable, so it is recommended that soil tests and fertility strip trials be conducted before making recommendations for sulphur fertilization with manure.

- Micronutrients

Micronutrients, such as copper, zinc, iron and other metals are found naturally in soil as well as in both manure and some commercial fertilizers. They are required in small amounts for optimum crop performance. Reduced crop performance can result from either a deficiency or an excess of micronutrients. The level of micronutrients in manure is at such levels that they will not build up to toxic levels in the soil if manure is applied at rates to meet nitrogen and/or phosphorus requirements. Soil and plant tissue tests can be performed to verify the micronutrients levels if necessary.

- Salts

Salt levels in manure should be minimized through diet manipulation to prevent buildup of salts in the soil and/or groundwater. Excessive salt levels in soil can result in reduced crop growth because water availability to plants becomes restricted. Sodium salts should be at low levels relative to calcium and magnesium salts to prevent the development of undesirable soil structure effects, such as crusting and impaired drainage. In most cases, the addition of large amounts of carbon (organic matter) through manure applications will offset the effect of adding a relatively small amount of soluble salts to the soil.

- Weed seeds

Some weed seeds may retain their integrity and viability even after digestion by livestock. Weed seeds can be effectively destroyed by feed grinding, rolling or other aggressive treatment during the feed milling process. Viable weed seeds appear to be fewer when passed through the digestive track of poultry.

- Microorganisms

As discussed in section 3.6, livestock manure contains a broad spectrum of microorganisms. Elementary hygiene is required when handling livestock manure.

4.1.3 Measuring manure nutrient content

It is important to know what the nutrient content of the manure is before applying the manure to land so that the application rate is such that it meets crop nutrient requirements. A well-mixed, representative sample should be analysed in an accredited laboratory on an annual basis. Field test kits for manure nitrogen and phosphorus contents are available for quick determination in the field, but should be checked against a laboratory analysis to verify their accuracy.

Given the differences in feed rations, amount of washwater used and the way manure is handled and stored from one operation to another, it is crucial to conduct a manure analysis of one's own operation. Since the nutrient value of manure can vary widely from one operation to another, using general data

TABLE 4: TYPICAL POULTRY MANURE NUTRIENT CONTENT[1]

Parameter	Total Nitrogen	Ammonia	Organic Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)	Dry Matter
Solid manure (kg/tonne)	17.20	1.15	16.05	15.20	14.05	60
Liquid manure (kg/m^3)[2]	5.30	4.80	0.50	1.17	1.72	4

[1] See Appendix C for imperial units.

[2] 1 kg/m^3 = 1 kg/ 1000 L

to estimate the nutrient content of manure (Table 4) should only be a last resort (refer to the Manitoba Agriculture and Food fact sheet *Manure as a Resource*).

4.2 ODOUR CONTROL

Land application of manure can be a major source of legitimate concern to neighbours of livestock operations. Odours released during manure application, although often carried out only once or twice a year, many be unpleasant and last a few days. Producers must be considerate of their neighbours in choosing land application techniques and in planning their annual manure application.

4.2.1 Equipment selection

The amount of odour released during manure application is a function of exposure of manure to air and wind. More care in timing and selecting fields for application will be necessary when the application equipment allows manure to be exposed to evaporation during and after application.

4.2.1.1 Solid manure spreading

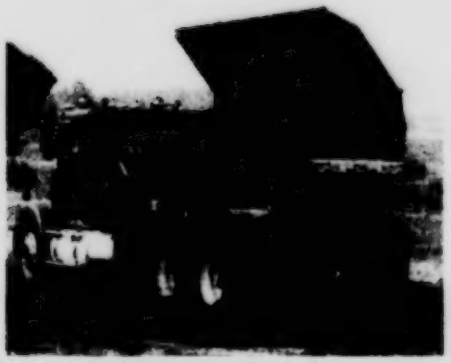
Spreading of solid manure by far is less a source of odour concerns than land application of liquid manure. Because of low moisture content in the barn and after short-term storage outdoors, solid manure from broiler operations does not usually develop strong odours; if at all, the main odour would be ammonia.

Most solid manure spreaders are box-type. Others include flail-type spreaders, side delivery spreaders, and various types of wagons. A spreader should distribute manure uniformly; dump trucks, front-end loaders, scrapers and blades are not appropriate for spreading solid manure.

Pull-type box spreaders are most common on smaller farms

Box-type spreaders are either tractor pulled or mounted on trucks. Pull-type box spreaders have capacities ranging between 2.5 to 18 m^3 (90 to 650 ft^3). Truck-mounted spreaders hold 6 to 18 m^3 (220 to 650 ft^3). Spreader mechanisms include paddles, flails and augers. The feed apron, which moves the manure to the spreading unit, often features a variable feed control. To contain liquids during transport, many spreaders have a rear gate, which once in the field is lifted for spreading.

Flail-type spreaders are tanks with open tops and usually have a shaft mounted near the open top and parallel to the main axis of the tank. Chain flails on the shaft throw manure out the side of the spreader as the shaft turns at high speed.



Truck-mounted box spreader allow for faster spreading

4.2.1.2 Liquid manure spreading

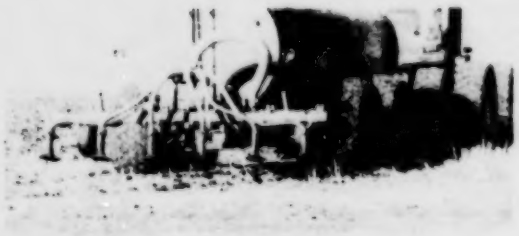
The potential for odour problems is much less with the use of manure tankers (honey wagons) for broadcasting the manure, since the manure is discharged in larger droplets than if otherwise discharged through irrigation systems. Although uncommon in the poultry industry, irrigation cannons may be a practicial alternative to spread large volumes of liquid manure or runoff water from outdoor ranges.

Liquid manure tankers typically hold 6 000 to 36 000 litres (1 300 to 8 000 gal) and have a low to moderate capital cost, depending on the spreading option and axle configuration. One disadvantage is the amount of time required to spread the manure with these tankers. Even when fields are near the storage, a large part of the time is spent travelling back and forth. The other disadvantage is the potential for soil compaction that occurs from transporting the heavy loads over moist soil. It is important to select or equip tankers with high-flotation tires (e.g. tire sizes such as 26L-28). Heavy truck tires and used airplane tires should be avoided, as they limit floatability and may induce severe compaction.

Conventional liquid manure spreader with a bottom splash plate

Incorporation of manure, whether in liquid or solid form, on the same day as application can markedly reduce odours neighbours may encounter (see Table 5). Each day that passes without incorporation only increases the risk for nuisance to neighbours. Rapid incorporation also maximizes nutrient retention for crop use.

The less manure travels in the air, the fewer the odours emitted. Low-level applicators and dribble bar systems that direct manure toward the ground considerably reduce volatilization during spreading. When used on a growing crop, dribble bars deposit manure directly on the soil with little covering of the crop. Fewer odours are emitted following application in this fashion than with broadcast applicators, even in the absence of incorporation.



Injection tool bar mounted on a liquid manure tanker

For liquid manure, the most effective means of odour control during land application is direct soil injection. When manure is injected (or incorporated into the soil very soon after application) both nutrient loss and runoff are minimized. Injection must be done before the soil is frozen.

TABLE 5: NUTRIENT LOSS, ODOUR SUPPRESSION AND RECOMMENDED SETBACKS FOR SPREADING LIVESTOCK MANURE WITH DIFFERENT METHODS

Application Method	Ammonia loss (%)	Odour Suppression	Recommended Setbacks (m)[1]		
			Property Line	Residence	Designated Residential Area
Injection	0-2	Maximum	3	15	75
Surface applied, incorporated within 2 days	15-25	Good	10	75	400
Surface applied, no incorporation	40-60	Moderate to none	10	150	800
Irrigation	60-80	None	15	300	1,600

[1] See Appendix C for imperial units.

The success of any method of application depends largely upon the abilities of the operator. With proper management, each system can be used in a manner that prevents pollution, minimizes odour nuisance and applies manure at a rate that matches the crop requirements.

4.2.2 Manure management stewardship

Neighbours are less likely to complain if they understand the problems of odour control. They will also be more tolerant if they can see that a genuine effort is being made by the producer to minimize the odours. Maintaining good communication with neighbours is important in avoiding conflicts. Most people will recognize good intentions and will not have unreasonable expectations. The following points should be considered as part of the preparation steps for the annual manure application operation:

- inform your neighbours ahead of time of your intentions to spread and attempt to accommodate them by spreading at times when odours are least likely to be a problem;
- avoid applying manure immediately before or during weekends and holidays when neighbours are more likely to be outdoors;
- incorporate manure as soon after broadcast or irrigation application as practically possible;
- consider injection for those fields adjoining many residences;
- make use of windbreaks or shelterbelts: the presence of trees will help to mix and dilute the odours by creating turbulence.

When spreading, maintain separation distances that are reasonable for the type of equipment used and account for the above considerations. Recommended minimum setback distances for spreading are presented in Table 5. These minimum distances are designed to minimize odour nuisances to neighbours and should be used in conjunction with good management practices.

4.2.3 Weather conditions

The capacity of the manure storage will determine how often the manure is spread. The storage should be large enough to permit some flexibility in timing the manure spreading. Spreading should occur at an optimal time for plant uptake of the manure nutrient. The storage size should be such as to allow avoiding unsuitable weather and field conditions. See section 3.4.2 for information on sizing a manure storage.

Factors to consider when deciding on where and when to spread are:

- manure spread in cool or cold weather will create less odour than spreading in warm weather;
- the best time to apply manure is early in the day, when air near the ground will tend to become warm and rise, carrying the odours upward where they will be diluted. The manure will dry and less odour will be released by evening;
- wind direction and speed are critical. Wind will help to dilute the odours by increased mixing with the air. Caution must be used to avoid situations where winds will carry odours directly toward a neighbour;
- on calm, humid days, rapid drying of the manure and dilution of the odours will not occur. A gentle breeze may carry the undiluted odours toward neighbours;
- avoid using fields a short distance upwind of neighbours. If possible, select a field further away where conditions are more favourable.

4.3 PREVENT POLLUTION

Following excretion, manure properties change with time as a result of biological, chemical and physical processes. Depending on how the manure is stored and applied to land, some of the nutrients may be lost. The amount of water added by washing, or the amount of straw or shavings added to bedding, will also change the final manure properties.

The methods of handling, storing and spreading manure also affect the final amounts of nutrients available to crops. Nutrients such as nitrogen, phosphorus and potassium not used by livestock are returned to the soil where they may be used by plants. Proper management when applying manure can prevent soil erosion, runoff and leaching of nutrients away from the soil and into water sources, avoiding pollution risks.

4.3.1 Nitrate leaching and groundwater contamination

Nitrate is among the nutrients most often applied to soils for crop production, either as part of commercial fertilizer or as a constituent of livestock manure. Nitrate leaching is a phenomenon that occurs when excess nitrate-nitrogen, the water-soluble, plant-available form of nitrogen, is moved down the soil profile by infiltrating water, such as that from a heavy rain or snowmelt. Groundwater nitrate levels greater than 10 ppm are of particular concern. The risks for health associated with elevated nitrate levels in drinking water are described in section 4.6.

It is important to remember that the organic nitrogen portion in manure does not leach. Instead, it gradually becomes available as the crop grows. **Properly managed manure applications, like properly applied commercial fertilizers, pose very little risk of nitrate leaching and groundwater contamination** (refer to Manitoba Agriculture and Food's fact sheets *Nitrogen Dynamics*, *Retrieval Strategies for Deep Leached Nitrates* and *Manure Nitrogen Losses and Prevention*).

If manure is applied to a single field on a continual basis (annually or more frequently), the risk of nitrate leaching from manure applications can be minimized by applying manure at rates that do not exceed crop requirements. Ideally, manure should be applied so that nitrogen is available to the crop at the appropriate time and in the appropriate amount. While spring applications may be desirable in this respect, fall applications may often be more practical in areas where springtime crop management practices limit opportunities for manure spreading.

Continual applications of manure will result in the buildup of organic nitrogen in the soil. Although not immediately available to crops, the organic nitrogen will gradually be

converted to nitrate-nitrogen through a process called mineralization. After several manure applications, the amount of nitrogen mineralized from organic nitrogen may be significant enough that future applications of nitrogen fertilizer, whether from manure or inorganic sources, will have to be adjusted using soil testing data. Contact a professional agrologist or your soil testing laboratory for information on soil testing for mineralizable nitrogen.

4.3.2 Sensitive groundwater areas

In some areas, soil and groundwater conditions may be sensitive to agricultural practices that involve the application of either inorganic or organic (manure) fertilizers. The degree of sensitivity depends on the type and depth of overburden (soil, subsoil and parent material) above an aquifer and the type of vegetation at the soil surface.

Where very permeable soils such as coarse sands or gravel immediately overlay an aquifer or where the overburden above an aquifer is very shallow, nutrients applied to the soil surface may leach rapidly downward and beyond crop rooting depths, and eventually reach the aquifer. In addition, since these areas tend to be well-drained, crop vegetation is often relatively sparse and plant uptake of nutrients is low.

Management is the key! Although the risk of nitrate leaching below the root zone to groundwater is greater on sandy soils, more intensive management can ensure that manure is not overapplied and the risk of nitrate leaching remains low. Such management practices for coarse or sandy soils include:

- spring/summer applications only;
- shallow injection, surface banding and broadcasting;
- crops with high demand for nitrogen, deep root systems and early spring growth;
- regular testing and monitoring of soil, groundwater, plant tissue (see Appendix F Soil Sampling Procedures);
- accurate record keeping of manure management data.

Consult a professional agrologist for site-specific recommendations in these sensitive areas before applying manure.

4.3.3 Soil pollution

Over-application of manure to soil can result in the buildup of nutrients in the soil. In addition to increasing the risk of nitrate leaching, a prolonged over-application of manure can lead to an imbalance in the soil chemistry, which will result in reduced crop yields. The Livestock Manure and Mortalities Management Regulation (see Appendix B) specifies the maximum nitrate levels that should be found in the first 60 cm (24") of the soil. Nitrates in excess of these values are considered as evidence of soil pollution under this regulation. Nitrate retrieval strategies can be implemented to remediate this situation (see Manitoba Agriculture and Food fact sheet *Retrieval strategies for deep-leached nitrates*). High concentrations of some micronutrients in manure may be detrimental to plants. Soil-test on an annual basis to monitor the nutrient status of the soil.

4.3.4 Seasonal considerations

Manure will gradually decompose in the soil zone. As decomposition occurs, nutrients from the manure become available for use by the plant. These nutrients, however, also become susceptible to losses through leaching or runoff.

Fall application will usually result in the loss of more nutrients than spring application if the manure is not incorporated into the soil. However, there is usually more time in the fall for manure applications than in the spring. In addition, the soil is often quite firm and dry at this time. If compaction does occur, winter

freezing and thawing of the soil can offset the damage.

Summer application is suitable for pastures, forage crops and summerfallow. Additional care should be exercised when applying manure to summerfallow, since these fields usually release enough nitrate-nitrogen during the summer to meet the next year's crop demands. Nitrates are more prone to leaching from light-textured soils. Soil sampling to a depth of 1.2 m (4 ft), either in fall or next spring, is a good idea when applying manure to summerfallow and to light-textured soils.

4.3.5 Distance to surface water

In order to reduce the risk of runoff entering surface water, a buffer area is necessary to absorb the runoff and prevent it from travelling downslope. The effectiveness of a buffer depends upon factors such as soil conditions and application rate. Good judgment must be used in all cases to ensure that runoff cannot enter water sources. Table 6 should be used as a guideline for application setbacks from watercourses and wells. The field slope must be considered when applying manure. As the slope increases, so does the chance that manure may run off. On steeply sloping land (greater than 12 per cent), extra caution must be used when applying manure, especially when high-volume irrigation equipment is used. Erosion and/or runoff should be prevented or susceptible areas avoided during application. A reasonable amount of crop or residue cover should be maintained to provide additional protection against erosion.

4.3.6 Winter spreading

Winter spreading of manure is not recommended, because manure applied to frozen soil does not readily infiltrate into the soil and thus increases opportunities for runoff to enter surface watercourses and adversely affect the water quality. In addition, winter application of manure is the least desirable time for a crop producer to apply manure to land because more nutrients in the manure will be lost due to volatilization and spring runoff than applications at any other time of the year. Section 14 of the Livestock Manure and Mortalities Management Regulation (see Appendix B) does not permit winter manure applications for operations larger than 400 animal units. Existing operations (in place before April 1998) have until November 10, 2003 to come into compliance with the prohibition of winter manure application. Refer to the Livestock Manure and Mortalities Management Regulation for a definition of livestock operation size for the purpose of the application of the regulation.

TABLE 6: RECOMMENDED DISTANCES[1] FROM WATERCOURSES, SINKHOLES, SPRINGS, WELLS AND RESIDENTIAL PROPERTY LINES FOR MANURE SPREADING (m)[2]

Slope	Application Method		
	Surface Applied and Irrigation[3]		
	No incorporation	Incorporation within 48 hours	Injection
less than 4%	30	20	5
4 - 6%	60	40	10
6 - 12%	90	60	15

[1] Distances based on soil not supporting perennial forage crops or with minimal trash cover.

[2] See Appendix C for imperial units.

[3] Where a perennial forage crop or good trash cover is present, distances may be reduced by 1/2.

TABLE 7: REQUIRED[1] DISTANCE FROM WATERCOURSES, SINKHOLES, SPRINGS, WELLS AND RESIDENTIAL PROPERTY LINES FOR MANURE SPREADING BETWEEN NOVEMBER 10 AND APRIL 15 (m)[2]

Slope	Application Method		
	Surface Applied and Irrigation		
	No incorporation	Incorporation within 48 hours	Injection
less than 4%	150	N/A	N/A
4 - 6%	300	N/A	N/A
6 - 12%	450	N/A	N/A
Greater than 12%	Prohibited	Prohibited	Prohibited

[1] Refer to the Livestock Manure and Mortalities Management Regulation – Appendix B.

[2] See Appendix C for imperial units.

Operations smaller than 400 animal units may apply manure on frozen soil, provided the manure does not leave the property as runoff in the spring. This operation should be carried out in compliance with the Livestock Manure and Mortalities Management Regulation and observe setback distances in Table 7. Winter spreading on land with slopes greater than 12 per cent is prohibited.

If manure must be applied in the winter, apply to stubble fields with adequate trash cover or to perennial forage fields. Surface cover reduces runoff volumes. Apply to fields with limited access first, leaving nearer fields for later when access is more difficult due to snow or thawing conditions.

4.4 APPLICATION RATE

Section 12 of the Livestock Manure and Mortalities Management Regulation stipulates that a manure application rate should provide no more nitrogen than required by a crop. Some situations may warrant that the rate be calculated on the basis of phosphorus requirement. This may even be more economical for some crops.

Nitrogen is usually the nutrient that determines the manure application rate. The rate of application will ultimately be determined by the nutrients required by the crop and by the soil nutrient reserves. The fertility status of a field is determined by soil testing (see Appendix F). Depending on how the manure has been handled, the nutrient content of the manure can vary widely. Therefore, the manure should be tested for nutrient content as well (see Manitoba Agriculture and Food's fact sheet *Manure as a resource*). The application rate can be calculated from this information together with the knowledge of the method of application, timing and soil conditions.

The application rate is often based on estimated soil and manure nutrient levels. Inaccurate information in this regard may lead to application rates either lower or higher than required. A moderate over-application will not immediately lead to pollution problems or crop damage, especially for the dryland conditions that exist in Manitoba. With excessive application rates, nitrogen and phosphorus will generally accumulate in the soil and this accumulation can be detected through subsequent soil fertility tests. If an accumulation occurs, the rate of future applications should be reduced accordingly. Recording the manure application date and rate on each field is one way to avoid long-term over-application and ensure accurate records if needed. A recommended procedure for soil sampling for nitrate-nitrogen is outlined in Appendix F.

4.4.1 Losses during application

The application method will have a great bearing on nitrogen losses following

application. Losses due to ammonia volatilization for each of the most common application strategies are summarized in Table 8.

4.4.2 Soil and crop implications

There is considerable variation in the amount of nitrogen required by different crops. Forage crops such as alfalfa can utilize much more nitrogen than annual cereal crops. Alfalfa is a deep-rooted plant and is capable of withdrawing nitrate-nitrogen, which may have leached below the root zone of annual crops. However, alfalfa is a legume and can manufacture its own nitrogen. Manure may be more profitable when applied to meet the nitrogen requirements of a crop that needs nitrogen. This will allow for a reduction in purchased commercial fertilizer.

The soil characteristics of the field where manure is to be applied should be known. On light-textured (sandy) soils, time the application of manure to maximize use of the nutrients by the crop. The application rate on heavy-textured (clay) soils may be limited by the rate at which liquid manure can infiltrate into the soil. Limit the application rate to avoid ponding or runoff.

The yield potential and the nitrogen requirement are considerably higher on heavy-textured soils than on well-drained sandy soils. In addition, the risk of groundwater pollution by nitrate leaching is greater on sandy soils than on heavy-textured soils. Therefore, the allowable manure application rate is higher on heavier-textured soils. Refer to Table 9 for nitrogen application rates.

TABLE 8: LOSS FOR MANURE NITROGEN DURING AND AFTER APPLICATION

Application Method	Nitrogen Loss (%)
Injection (immediate incorporation)	0-2
Broadcast, incorporation within 2 days	15-25
Broadcast, incorporation after 2 days	25-35
Broadcast, incorporation after 3 days	40-60
Broadcast, no incorporation and on established forage	35
Irrigation, incorporation within 3 days	25-35
Irrigation, no incorporation after 3 days	60-80

TABLE 9: GENERAL RECOMMENDATIONS FOR NITROGEN APPLICATION RATES

Crop	Soil Type	Recommended (kg/ha)[1]
Forages, established stands		
Alfalfa	all types	250
Grasses	all types	165
Grass-Alfalfa Mixtures	all types	195
Annual Crops	Medium to heavy soils	90
	Light soils	65

[1] See Appendix C for imperial units.

Fields receiving annual applications of manure should be tested annually. The samples should be taken at least to a 60 cm (24") depth and analyzed for nitrate-nitrogen, and, if possible, for potentially mineralizable (potentially available) nitrogen.

Caution should be exercised not to over-apply manure, particularly on coarse-textured sand and sandy loam soils. Excessive rates of manure can also have a negative impact on crops by causing excessive vegetative growth, lodging, and/or delayed maturity. Appendix F outlines a procedure for monitoring fields used for manure application.

The Livestock Manure and Mortalities Management Regulation lists maximum nitrate-nitrogen levels to be found in the 0-60 cm (0-24") depth of soil. These values must not be exceeded. In all cases these values represent sufficient amounts of nitrogen to grow high-yielding crops. Soil testing should still be conducted to determine the optimum level of nitrogen fertilizer to produce optimum yields and quality for a given area. Refer to Appendix F, Soil Sampling Procedures, for more information.

4.4.3 Acceptable application rate

Using the above information, it is relatively simple to calculate the rate required to meet the nutrient demand of a crop. Ideally, producers need to first obtain soil and manure test data to determine the application rate that will closely match the nutrient requirements of the crop.

Although general recommendations are provided here, annual soil and manure testing is the best approach to calculating an application rate. Annual soil testing allows one to detect any changes in the nutrient content of the soil (refer to Manitoba Agriculture and Food's fact sheets *Soil Sampling Strategies for Site-Specific Management* and *Calculation of Manure Application Rates*). A trend in soil nutrient level may require modification to either the crop rotation or the manure management planning. Table 10 presents a simplified worksheet approach to determining the application rate for livestock manure.

4.4.4 Crop planning and selection

Crops fertilized with manure at application rates that meet the crop's nutrient requirements produce yields comparable to that of commercial fertilizer. Fertilize for target yields that are typical for the region (crop insurance data may provide guidelines). If you fertilize for a target yield and the crop produced does not attain that yield, monitor soil nutrient levels and adjust your target yields accordingly for future crops.

Designing a crop rotation for manure application should be no different from designing one for a system using commercial fertilizer. Since the nutrients from manure are handled and applied in a different manner than those from commercial fertilizer, some modifications may be warranted. Include crops in the rotation that not only use the nutrients from the manure most efficiently, but also develop rotations with intensity and diversity to overcome other agronomic challenges, such as weed pressure, disease pressure, insect attacks, residue management, moisture management and workload distribution (contact Manitoba Agriculture and Food for more information).

At times, the costs of handling and applying the manure may seem high when compared on a pound-per-pound nutrient basis with commercial inorganic fertilizers. However, proper periodic applications can result in substantial long-term improvements in the physical characteristics of the soil. Manure should be viewed as a resource to be properly managed, rather than a waste requiring disposal.

4.4.4.1 Spreading on pastures

Livestock manure is an excellent fertilizer for pastures. As part of overall manure management planning, some consideration should be given to allowing forage crops a period of time to make use of the applied nutrients. This practice will ensure a stronger regrowth of the pasture forages.

A rest period to allow for pasture regrowth prior to grazing will also allow natural environmental factors to inactivate potential pathogens that may be present in manure. Livestock should not be reintroduced to pastures on which manure has been broadcast-applied for at least 30 days.

Livestock must not be present on the pasture when manure is being applied. Delaying grazing following broadcast-spreading of manure, in keeping with recommended rest periods for pastures before grazing, is also suggested as a preventive measure against potential pathogenic organisms that may be associated with livestock manure. Application of manure from a livestock species onto a pasture to be grazed by a different livestock species may be an effective way to interrupt the chain of infection from pathogens to livestock. Certain application techniques or situations may allow for shorter withdrawal periods. The Manitoba Veterinary Services Branch can provide advice on this issue.

4.4.5 Manure management plans

Every livestock operation should keep track of manure application rates and nutrient content, application method and times, crop grown and yields, etc. as applied annually on each field. The Livestock Manure and Mortalities Management Regulation (see Appendix B) requires that all livestock operations with more than 400 animal units register an annual manure management plan 60 days prior to applying manure to their fields. The Manure Management Plan registration form required for this purpose is reproduced in Appendix G.

Manitoba Agriculture and Food developed an application rate calculation software ("MARC98") to design manure management plans. This software allows for easy bookkeeping of the information on a field-by-field basis, along with a summary of the net cost of manure application, being the difference between the application costs and the value of the applied nutrients as used by plants. In addition, the software is programmed to fill in the manure management information directly on the Manure Management Plan registration form required by Manitoba Conservation.

4.5 ECONOMIC BENEFITS FROM SOUND MANURE MANAGEMENT

The direct economic benefits to be derived from livestock manure management rest in the ability to replace commercial fertilizers as a source of plant nutrients. To illustrate the extent of potential profits, consider the example shown in Table 10, which presents a typical scenario with annual crops (e.g. small grains). Commercial fertilizer prices for spring 1998 (N at $ 0.73/kg and P_2O_5 at $ 0.62/kg) and an average cost of $10/tonne ($9/ton) for custom application of solid manure can be used to demonstrate the costs and benefits of manure management. In the example shown in Table 10, solid poultry manure applied to provide 26 kg/ha of nitrogen and 45 kg/ha of phosphorus would replace the equivalent of $47/ha of commercial fertilizers; this compares with a manure application cost of about $36/ha, highlighting important benefits from spreading.

Poultry manure contains very high phosphorus concentrations. Referring to the example of Table 10, applying solid poultry manure according to its nitrogen content only would have resulted in the application of 156 kg/ha of phosphorus; this is 3.5 times more than small grains can use. Recalling that phosphorus is quickly made unavailable to crops in soils, the equivalent of $70/ha would be forgone in unused phosphorus. Moreover, continuing this practice for many years could lead to significant phosphorus buildup in soils. Poultry manure application rates should be calculated on the basis of phosphorus content wherever practical.

TABLE 10: MANURE APPLICATION RATE CALCULATION WORKSHEET[1]

Step 1. Soil Test Data – from the laboratory report ***Solid Poultry Manure***		**Field Identification:**		Example **Units**
Nutrient target rate:	Nitrogen	90	(A)	kg/ha or lb/ac
	Phosphorus (as P_2O_5)	45	(B)	kg/ha or lb/ac
	Other:_____			kg/ha or lb/ac
Step 2. Manure Test Data				kg/tonne or lb/ton
	% moisture	27.3		
	Total Nitrogen:	25.3	(C)	
	Ammonia Nitrogen:	1.7	(D)	
	Organic Nitrogen (C-D):	23.6	(E)	
	Phosphorus:	10.8	(F)	
	P_2O_5 (F × 2.3):	24.8	(G)	
Step 3. Amount of manure nutrients available to crop:				
	application method:	*Broadcast and incorporated 1 day later*		
Nitrogen volatilization losses due to application method (Table 8)		25%	(H)	
Organic nitrogen available in first year (E × 0.25)		5.9	(I)	
Ammonia nitrogen available (D × [100 – H]/100)		1.3	(J)	
Total nitrogen available in growing season (I + J)		7.2	(K)	kg/tonne or lb/ton
Phosphorus availability factor:		50%	(L)	
Total available phosphate (G × L/100)		12.4	(M)	kg/tonne or lb/ton
Step 4. Application rate based on N or P requirements:				
Nitrogen target rate (A) ÷ (K) = Application Rate (N) 90 ÷ 7.2 = 12.5		12.5	(N)	tonnes/ha or tons/ac
Phosphorus target rate (B) ÷ (M) = Application Rate (P) 45 ÷ 12.4 = 3.6		3.6	(P)	tonnes/ha or tons/ac
Compare applications rates vs. nutrients (N ÷ P): If (O) is greater than 2.5, then apply the lowest rate		3.5	(O)	
Step 5. Balance nutrients for crop requirements				
Application rate		3.6	(Q)	tonnes/ha or tons/ac
	Nitrogen applied (K × Q)	25.9	(R)	kg/ha or lb/ac
	Phosphorus applied (M × Q)	45	(S)	kg/ha or lb/ac
	Nitrogen to add (A - R) → 90 – 25.9 =	**64 kg/ha**		Add as starter fertilizer
	Phosphorus to add (B – S) → 45 – 45 =	0		

[1] See Appendix C for Imperial Units and a blank template worksheet.

In the case of liquid poultry manure, rapid incorporation and direct injection are techniques that will usually completely offset spreading costs, as these retain the most nutrients for crop production. These techniques are also very effective for avoiding odours during land application.

4.6 HEALTH CONCERNS REGARDING LAND APPLICATION OF MANURE

By and large, community health issues with regards to zoonotic diseases are not a general concern as long as the precautions indicated in section 3.7 are followed and the setbacks from residences listed in Table 5 maintained. The topic of potential relations between odours and health is addressed in detail in section 5.2; when spreading in close proximity of neighbours, the alternative practices presented in section 4.2 will adequately address potential concerns.

However, failure to consider soil fertility status and plant nutrient requirements when making decisions on land application rates of manure or commercial fertilizer could raise concerns in some regions regarding nitrate levels in drinking water. Health concerns due to elevated nitrates in drinking water are described below.

4.6.1 Nitrates in drinking water

Drinking water may contain nitrates from natural sources (e.g. peat bogs), commercial fertilizers, domestic sewage systems and manure. Careless or improper storage, excessive rate of application of manure, as well as improperly protected well casings, may result in well-water contamination. The best preventive measure is to apply plant nutrients from manure or commercial fertilizers at rates matching plant requirements.

The acceptable maximum for nitrate in drinking water is 10 mg/L (measuring nitrate as nitrogen). Below 10 mg/L, nitrate does not appear to cause health problems. Above this level, there may be health concerns, particularly for babies less than one year and for pregnant women. Infants can develop a condition called methemoglobinemia, which causes a lack of oxygen (blue-baby syndrome). In pregnant women, the presence of nitrate may cause a lack of oxygen for the baby. Blue-baby syndrome is entirely preventable by avoiding the consumption of water high in nitrates.

Although adults have a higher tolerance for nitrates, some studies suggest an association between nitrates in drinking water and the development of stomach cancer.

As there are many sources for potentially elevated nitrate levels in drinking water from private wells, it is advisable to have the water tested, and even more so if the members of the household include pregnant women or infants. Contact your regional Manitoba Health office for advice as to how to have your drinking water tested.

SECTION 5 ODOUR CONTROL

Odours are one of the main causes of conflicts between livestock producers and their neighbours. In most areas, livestock producers are a small minority of the population. It is therefore essential that livestock producers develop and maintain a positive image within their community. One of the key elements in being a good neighbour is to make every reasonable effort to control odours. It should be the goal of all livestock producers to design, construct and manage their operations in a manner that minimizes the odour experienced by their neighbours.

It is unrealistic to expect a commercial poultry operation to operate without some odour. The odour level of a poultry operation can, however, be significantly reduced when manure management systems are properly designed and operated. The odour level created by a livestock operation can be thought of as the combination of four factors: the frequency, the intensity, the duration and the offensiveness (FIDO) of the odours. The purpose of this section is to present some ways to manage the FIDO from livestock operations, and compare their effectiveness with their disadvantages. However, while some practical methods to minimize odour concerns from livestock operations are described, no single practice or technique will totally eliminate emissions of odours.

Odour control within and around livestock operations should not be regarded as only a public-relations issue. The control of odours within the barn is also beneficial for the welfare of the livestock and the people working in the barn. Frequently, the conditions that contribute to odours also reduce animal growth rates and can make the livestock more susceptible to disease.

5.1 WHERE ODOURS COME FROM

The odours generated by livestock operations are produced mainly by decomposition of manure by various microorganisms. The activity of the different microorganisms (which depends upon manure temperature, moisture content, oxygen level and other characteristics) determines the type of gases and the rate at which gases are produced. When enough oxygen is available, manure decomposes **aerobically**, and most of the gases released have very little odour. However, when microorganisms are deprived of oxygen, manure decomposes **anaerobically** and most of the gases released have an offensive odour. Both decomposition processes are involved in the various phases of a manure management chain. The two main strategies for odour control are:

- to collect, store and spread manure in a way that prevents odours from forming; and
- to control the release of odours into the air so that their emissions can be minimized.

5.2 HUMAN RESPONSE TO ODOURS

Agricultural odours are a major concern raised by neighbours, who may feel that their health is being adversely affected.

Odours are perceived through the olfactory nerve endings inside the nose. Low-level smells are usually identified and able to be "lived with," depending on the context and length of time involved.

Some odour levels (for example those that may exist on the edge of manure storage structure) have a sufficiently strong and sharp quality about them that they can induce immediate symptoms and withdrawal in most people.

However, individuals certainly vary in their level of tolerance and sensitivity to even low-level odours. It is evident that, in some people, these repeated and unwanted odours can be very annoying and may result in such

symptoms as headache, nausea, eye and throat irritation, anxiety and depression.

The keys to reducing odour complaints are proper siting and good manure management. If producers follow the practices outlined in these Farm Practices Guidelines, there should be little impact on human health from odours.

5.2.1 Other air quality concerns

Community health risks from airborne microorganisms, dust, and other gases such as methane, ammonia, and hydrogen sulphide are generally not a concern. The dilution that occurs when barn air mixes with outside air results in negligible risk to neighbours. The use of some high-pressure irrigation equipment such as the "big gun" to apply manure to land should be restricted to remotely located fields, however, as bacteria can be transported downwind.

Most dust particles are deposited within a short distance from livestock housing exhaust fans. Although community health risks are negligible, agricultural workers may be exposed to high concentrations of airborne dusts and contaminants within livestock housing facilities. This can initiate adverse health effects to workers if proper prevention is not practised. Good ventilation, respiratory protection (masks) when performing dust generating operations, and dust reduction measures are methods to protect the health of barn workers.

5.3 SITES OF ODOUR PRODUCTION

Odours are generated in three areas:

- the facilities where animals are housed;
- the area where manure is stored; and
- cropland where manure is spread.

In general, livestock barns create a continuous source of odour because they operate year-round. Odour levels from barns, however, tend to be lower than those released during field spreading.

Depending upon the system used, fields where manure is applied can be the source of the operation's most offensive odours. The area used for spreading will nevertheless be an infrequent and intermittent source of odour.

To minimize nutrient losses by volatilization over the storage duration, liquid manure storage structures are designed as deep basins or tanks, providing for smaller surface area. However, this also allows for the development of unavoidable anaerobic decomposition of manure in the lower depths of liquid manure storage structures. Offensive odours can be released to the atmosphere during pump-out. Provided that enough litter material (e.g. straw) is used to prevent strong anaerobic microbial activity, solid manure piles do not result in as much odour as liquid manure storage structures.

Proper design of equipment and facilities, together with the use of appropriate management practices, will have a significant effect on the frequency, intensity, duration and offensiveness of the odour produced. Odour reduction strategies at the livestock facilities level are presented in this section. Odour control principles for land application were dealt with in section 4.2.

5.4 LIVESTOCK OPERATION DESIGN

The main characteristics of odours emanating from livestock production facilities are high frequency and sometimes long duration, as odours may be released continuously. However, the intensity and offensiveness of odours depend to a large extent on the design and management of livestock housing. Odours arise mainly from manure decomposition on the various surfaces in the livestock housing, inclusive of the bird's body. Barns with wet-manure covered floors will have more odour problems than barns having ample bedding material to absorb the moisture. A clean barn is the product of proper barn design, good management practices, properly designed and functioning ventilation systems, and healthy animals.

5.4.1 Manure management system

The manure handling system in a barn also affects odour production. Odours are reduced by either removing it from the barn as frequently as possible, or creating aerobic conditions within the manure.

Liquid manure systems are more conducive to the development of odours within and outside buildings. Straw-based or litter systems, on the other hand, will produce much less odour, as long as sufficient litter material is used to keep the litter relatively dry.

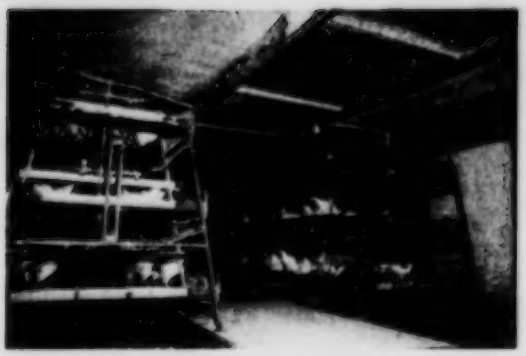
5.4.1.1 EGG PRODUCTION: LIQUID SYSTEMS

Most egg-laying barns use liquid manure systems consisting of shallow gutters (15 – 20 cm), which are emptied frequently. Operators usually add some water in gutters to facilitate removal. Frequent removal of manure from the housing reduces odour intensity from the building.

Cage stacks (battery) staggered one above the other use conveyor belts to remove undiluted manure out of the barn

Other systems are also available. Battery cages allow for continuous removal of manure with belt conveyors under each row of cages. Manure is handled in semi-solid form.

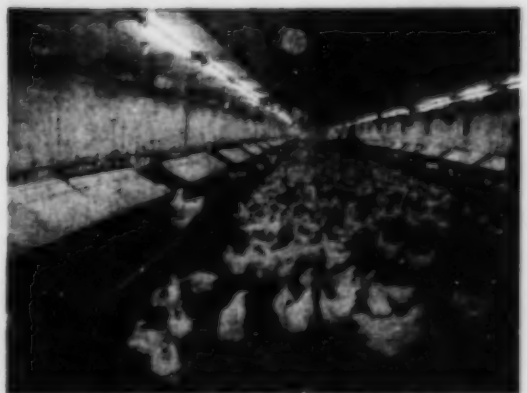
Few large operations dry manure into two or three stages by evaporating the liquid fraction from liquid manure evacuated with belt conveyors. This results in solid manure with lower overall volume, a product that may be attractive to horticulturists.



Tiers of cages are positioned over shallow gutters in egg production operations

5.4.1.2 STRAW-BASED LITTER SYSTEMS

In Manitoba, most broiler, broiler breeder and turkey operations raise their birds on solid litter, usually straw or wood shavings. To accommodate longer production cycles, broiler breeder operations utilize a $^{2}/_{3}$ slatted area under which solid manure can accumulate separately from the living area of the birds. The use of straw or other bedding can maintain aerobic conditions when enough material is used. Usually little odour emanates from straw-based litter systems and from the associated temporary manure piles when sufficient straw is applied in the housing.



Broiler and broiler breeder operations commonly raise their birds on straw

5.4.2 Housing environmental control

In the majority of livestock operations, the buildup of odours within the housing facility can be prevented by simply following recommended ventilation practices and rates. Proper ventilation rates are required to maintain dry floors. This also prevents the formation of very unpleasant "pockets" of air in the building. As well, the ventilation system should be such as to avoid drawing foul air from the gutter back into the housing. Consult a professional engineer or your Manitoba Agriculture and Food regional agricultural engineer for advice on your housing ventilation system.

5.4.3 Landscaping

Well-kept grounds, clean shelter belts and other common landscaping features will ensure that the owner's pride in his operation will be accurately conveyed to nearby neighbours and users of the rural roads. Appropriately groomed livestock operation yards, surrounded by trees, will usually produce fewer complaints from neighbours.

Shelterbelts – Carefully designed rows of trees or the maintenance of existing treed buffers around the perimeter of a livestock operation yard will play a dual role. First, they will help blend the physical facilities of the operation (buildings, yard, manure storage, heavy truck traffic, etc...) with the surrounding features of the local landscape. Second, trees will reduce the intensity of odours from the property.

Maintaining trees around the yard of a livestock operation is an asset

Rows of trees help disperse odours higher in the atmosphere. Also, trees act as a natural filter by collecting dust on needles and leaves. Rows of trees can also be designed to control snow accumulation around the yard and in low-lying manure storage structures, which may represent significant savings in some years.

5.4.4 Setbacks from neighbours

For new operations, one very effective way to reduce the intensity of odours transported to their neighbours' properties is locating the operations' facilities far enough from them to allow natural dilution of odours. Section 6 presents recommendations for practical separation distances to observe for livestock operations of different sizes. Whenever practical, the siting of the operation should also consider the prevailing wind direction to lessen the frequency of odours transported to the closest neighbours. Abiding by these recommendations will ensure that the odour frequency and intensity will be kept to low levels in most situations, unless special landscape features concentrate the odours in a given direction.

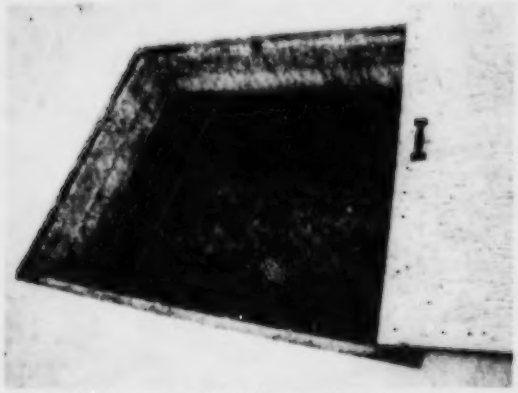
5.5 STORAGE ODOUR CONTROL

Manure is a valuable source of plant nutrients. Due to the cold climate in Manitoba, manure must be stored until it can be applied to soil for optimum crop production. This typically requires storage during winter months.

5.5.1 Storage methods

In the broiler industry, most of the manure is handled in solid form and presents moisture contents near 25 per cent. This is such that broiler manure usually does not allow for significant odours, if it is not allowed to be wetted during storage.

Liquid manure storage from most of Manitoba's large egg production operations is stored in covered manure tanks. This not only allows for low odour emissions, but also reduces nitrogen losses from the storage.



Open lid of a covered tank for liquid poultry manure

5.5.2 Setbacks

Odours naturally diffuse in the air immediately outside the perimeter of storage structures. Large separation distances allow the dilution of odours under normal climatic conditions. Maintaining large distances between the closest neighbors and a manure storage structure, and siting it such that predominant spring, summer and fall winds usually blow odours away from them, are very good ways to prevent future nuisance problems when planning new operations. Large setbacks ensure dilution of odours to non-offensive levels in most situations. Since larger storage structures have a larger surface area for odour emissions, setbacks must be greater for larger operations. Section 6 lists minimum separation distances recommended for siting manure storage structures.

5.5.3 Shelterbelts

Again, shelterbelts will greatly help in diffusing and diluting odours emitted by manure storage structures. Rows of trees planted around manure storage structures will also considerably improve the appearance of livestock operations.

5.6 ODOUR CONTROL PLAN

Defining the source of odours affecting a neighbour may not be a trivial task. The FIDO of odours from each source must be considered for a successful action plan. The advice of your Manitoba Agriculture and Food regional agricultural engineer in developing an odour abatement plan can prove very valuable. This would allow producers to identify the most probable source of odour or nuisance concerns, starting at the livestock housing management level. This would allow the producer to select the most appropriate actions and technologies to remedy a problem situation.

SECTION 6 SITE SELECTION

Planning the location of the facilities should take account of the features of the site and preserve treed buffers

When planning a livestock operation, the selection of an appropriate site is the most critical aspect. Naturally, there are many factors that must be considered when choosing a site. The location of the operation in relation to property lines, to neighbours and to rural residential developments can determine the potential nuisance issues for a proposed operation, as well as other considerations relative to its future growth. Greater separation distances afford more opportunity for odours to become diluted by mixing with the air. As the intensity of odours is reduced, the inconvenience to the neighbours will proportionally be alleviated.

6.1 SETBACK FROM PHYSICAL FEATURES

A minimum setback from property lines as illustrated in Table 11 is recommended. In addition, the Livestock Manure and Mortalities Management Regulation requires that all new manure storage structures be located at least 100 m from property boundaries or watercourses, sinkholes or wells.

The location of buildings, structures, fences, plantings and the establishing of various enterprises adjacent to provincial roads and highways is regulated by Manitoba Highways and Transportation. Access to provincial highways, and the discharge of surface runoff and liquids into highway ditches is also controlled by that Department.

Generally, construction of any buildings, structures and fences or planting of trees within or up to 76 m (250 ft) of certain provincial highways, or within or up to 457 m (1,500 ft) of major highway intersections requires a building permit from Manitoba Highways and Transportation. These distances vary from one highway to another and at different intersections; therefore, it is important to contact and consult with

Manitoba Highways and Transportation early in your planning.

6.1.1 Separation between livestock operations

Careful consideration must be given to the presence of other livestock operations when selecting a site for a new operation. Providing an adequate separation distance from other operations raising the same livestock species is an important step in preventing the spread of disease affecting livestock.

Animal diseases are transported by many unpredictable ways, such as rodents, birds, etc., complicating the formulation of recommendations for separation distances in this regard. The farther a new operation is from other operations of the same type, the lower will be the risk of introduction of a disease. Other preventive measures, such as setting up a bio-security program and ensuring proper pest control, are as important as providing adequate separation distances.

6.2 SETBACKS AND OTHER STEPS TO AVOID NUISANCE

Agricultural operations are a source of traffic, noise, dust and odours, even if only intermittently. One of the key elements to successful siting of a livestock operation is to observe appropriate separation distances between potentially conflicting land uses. This is of particular relevance to effective dispersion and dilution of odours emanating from the facilities of an livestock operation.

When evaluating sites for **new operations only**, it is advisable to select a location that will affect as few neighbours as possible. Table 12 recommends the maximum number of residences within a one-mile (1.6 km or 1,600 m) radius of various sizes of proposed operations. If the number of residences exceeds those given, an alternative site should be selected. Note, once again, this column in Table 12 applies to **new operations only**. Municipal property ownership maps are very useful for evaluating sites.

Recommended minimum separation distances from single residences and designated residential or recreational areas are shown in Table 12. These separation distances apply to new and expanding operations. Table 13 illustrates how various sizes and types of poultry operations relate to the animal unit equivalents. Larger separation distances are recommended as the size of the operation increases. Greater distances are also recommended for manure storage structures. **Municipalities may require different siting criteria from those mentioned here. The location of new operations should always be cleared with municipal authorities.**

TABLE 11: RECOMMENDED[1] SETBACK DISTANCES FROM PROPERTY LINES[2]

To animal housing structure	50 m
To manure storage structures[3]	100 m

[1] Agencies such as Manitoba Hydro or the rural municipality may have requirements in excess of these.

[2] See Appendix C for imperial units.

[3] Requirement of the Livestock Manure and Mortalities Management Regulation 42/98 – see Appendix B.

TABLE 12: RECOMMENDED CRITERIA FOR SITING LIVESTOCK OPERATIONS

Animal Units[1] (A.U.)	Maximum[2] Number of Residences Within 1600 m	Minimum Distance[3] (m)			
		From Single Residence		From Designated[4] Residential or Recreational Area	
		To Earthen Manure Storage	To Buildings and Non-Earthen Storage[5]	To Earthen Manure Storage	To Buildings and Non-Earthen Storage[5]
10 - 100	18	200	100	800	530
101 - 200	16	300	150	1200	800
201 - 400	14	400	200	1600	1070
401 - 800	12	500	250	2000	1330
801 -1600	10	600	300	2400	1600
1601 - 3200	8	700	350	2800	1870
3201 - 6400	6	800	400	3200	2130
6401 - 12800	4	900	450	3600	2400
12801 and greater	2	1000	500	4000	2670

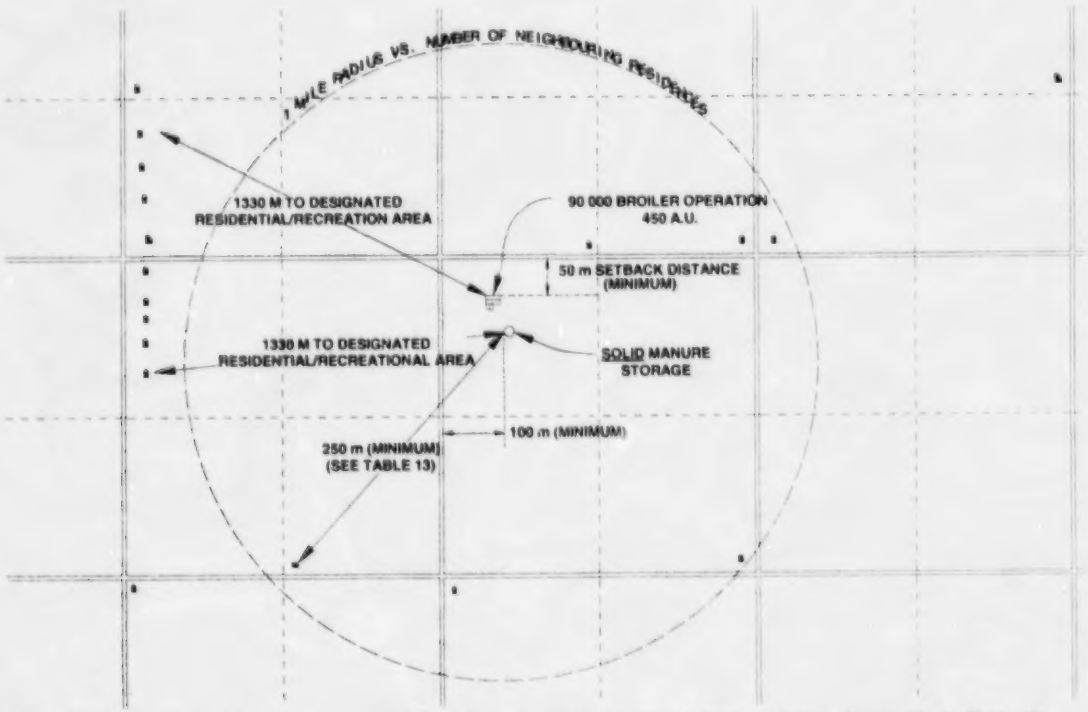
[1] Refer to Table 13 for number of animals.

[2] Number of residences within 1.6 km (one mile) of the centre of the facility applies only to new facilities. Expansions of existing facilities and the proponent's residence are excluded.

[3] These separation distances apply to new and expanding operations; see Appendix C for imperial units.

[4] Officially designated areas in a development plan or basic planning statement.

[5] The distance to buildings includes barns, solid manure piles and non-earthen manure storage such as above or below-grade structures, which may be covered or uncovered.


1 MILE RADIUS VS. NUMBER OF NEIGHBOURING RESIDENCES
1330 M TO DESIGNATED RESIDENTIAL/RECREATION AREA
90 000 BROILER OPERATION 450 A.U.
50 m SETBACK DISTANCE (MINIMUM)
1330 M TO DESIGNATED RESIDENTIAL/RECREATIONAL AREA
SOLID MANURE STORAGE
100 m (MINIMUM)
250 m (MINIMUM) (SEE TABLE 13)

The planning process must take into account setbacks from a number of physical features (setbacks shown refer to Table 12)

TABLE 13: CONVERTING NUMBER OF ANIMALS TO ANIMAL UNITS

CHICKENS						
Animal Units[1]	**Broilers**	**Roasters**	**Layers**	**Pullets**	**Broiler Breeder Hens**	**Broiler Breeder Pullets**
10 – 100	2000 - 20000	1000 – 10000	1200 - 12000	3000 - 30000	1000 – 10000	3000 - 30000
101 – 200	20001 - 40000	10001 – 20000	12001 - 24000	30001 - 60000	10001 – 20000	30001 - 60000
201 – 400	40001 - 80000	20001 – 40000	24001 - 48000	60001 - 120000	20001 – 40000	60001 - 120000
401 – 800	80001 - 160000	40001 - 80000	48001 - 96000	120001 - 240000	40001 - 80000	120001 - 240000
801 – 1600	160001 - 320000	80001 - 160000	96001 - 192000	240001 - 480000	80001 - 160000	240001 - 480000
1600 and greater	320001and greater	160001 and greater	192001 and greater	480001 and greater	160001 and greater	480001 and greater

[1]Refer to Appendix I for definition of Animal Unit.

TURKEYS			
Animal Units[1]	**Broilers**	**Heavy Toms**	**Heavy Hens**
10 – 100	1000 - 10000	500 -5000	1000 - 10000
101 – 200	10001 - 20000	5001 - 10000	10001 - 20000
201 – 400	20001 - 40000	10001 - 20000	20001 - 40000
401 – 800	40001 - 80000	20001 - 40000	40001 - 80000
801 – 1600	80001 - 160000	40001 - 80000	80001 - 160000
1601 and greater	160001 and greater	80000 and greater	160001 and greater

[1]Refer to Appendix I for definition of Animal Unit.

6.2.1 Using the landscape

Other factors to consider when selecting a site are trees, windbreaks, prevailing wind direction and air drainage (odour drift due to slope).

Many direct and indirect benefits can be derived by making proper use of naturally treed areas. Treed buffers and shelterbelts help reduce and disperse odours from a site very effectively (see section 5.4.3). Whenever possible, livestock structures and facilities should be well integrated into the landscape. Preserving natural vegetative buffers is an important aspect in blending modern structures and activities within the local landscape features. The image conveyed by a well-landscaped livestock operation will be an asset for its future growth.

Since every situation is unique, the most practical approach is to evaluate the situation with the assistance of an agricultural engineer and the land use planner for the area. The planner will be familiar with the zoning bylaws for the area and know of proposed subdivisions. The engineer can assist in obtaining weather data from Environment Canada and interpret the information for a particular site. The prevailing wind direction can vary between seasons. Since summer is the time when odours are more intense and neighbours are outdoors more often, it is important to consider the direction of the prevailing winds during the summer. This will minimize the number of times neighbours are exposed to odours.

6.2.2 Occasional air drainage

During calm, summer evenings, the air near the ground will be cooled and drift down a slope; this is known as air drainage. In much of Manitoba, the land is fairly flat, so air drainage is not a major concern. However, if an operation is planned where a neighbour's residence is in a downslope direction, the odour nuisance potential increases. As the air passes the livestock operation, it will pick up odours and create a problem. This condition may occur frequently during calm summer evenings, just at the time when most people like to be outdoors.

6.3 AVOID DIRECT CONTAMINATION OF WELLS

Additional setback considerations apply to manure storage structures. Plan the location of livestock facilities to maximize the separation from water supply wells. This is particularly important with field or earthen storage where groundwater is obtained from shallow wells or where bedrock is found close to ground surface.

Minimum separation distances required by the Livestock Manure and Mortalities Management Regulation (Appendix B) for manure storage structures are given in Table 2 (section 3). Wells should be located uphill from manure storage structures and constructed in a manner that will prevent pollutants from entering the well. Grouting the annular space outside the casing with cement or bentonite grout should be carried out where appropriate.

6.4 ENVIRONMENTAL CONSIDERATIONS FOR SITING

The geological and hydrogeological features specific to a site may warrant particular construction requirements for the facilities, as well as manure management. When choosing a site for a livestock operation, it is important to investigate these aspects.

6.4.1 Siting of the manure storage structures

When an earthen manure storage is planned, potential sites should be evaluated for their suitability for construction of this type of structure. Sites underlaid by shallow aquifers may not be suitable for an earthen storage structure. In these areas, it may have to be lined with suitable clay or artificial liners. Information on subsurface materials and the presence of aquifers can be obtained from existing soils and geological or hydrogeological maps or by examining water well logs (available from Manitoba

Conservation). In all cases, some exploratory drilling will be required to "prove out" the geological and hydrogeological conditions beneath the planned location of an earthen storage structure. In areas with complex geology or hydrogeology, specialized testing may also be required to evaluate site conditions. This will require the services of a qualified hydrogeologist or engineer.

6.4.2 Considerations for land application of livestock manure

The suitability of all fields identified for manure applications should also be assessed. To evaluate the potential for groundwater quality impacts from land spreading of plant nutrients, inclusive of manure and commercial fertilizers, the subsoil types of these fields have to be considered. In most areas, this can be done by consulting published soils maps, surficial geology maps or by examining water well logs (available from Manitoba Conservation).

Areas where the subsoil consists of coarse granular materials such as gravel or sand and gravel, as well as where bedrock aquifers are found close to ground surface, may be unsuitable for livestock manure spreading. In the Interlake and parts of southeastern Manitoba, where the bedrock consists of limestone and dolomite, potential fields for spreading should be carefully examined to determine if sinkhole features are present. Land application of manure is not recommended in close proximity to sensitive features such as sinkholes (see section 4 for recommended setbacks to observe). Where there are questions as to the exact nature and distribution of subsurface materials and the suitability of specific fields for spreading, a detailed plant nutrient management plan for these fields may have to be undertaken by a professional agrologist.

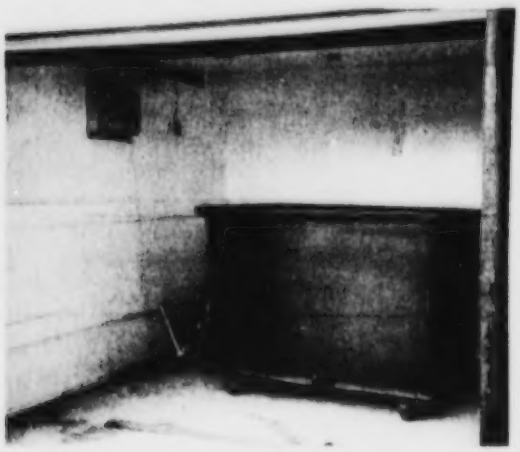
6.5 WATER RESOURCE AVAILABILITY

Sources and availability of water supplies should also be considered. Large livestock operations may require considerable amounts of water. In some parts of the province these volumes may be difficult to obtain. If surface water sources are being considered, ensure that the source, if it is a stream, flows at all times of the year and that the required amount of water is available for extraction.

A water rights licence may be required (see section 2). If considering a groundwater source, determine whether the aquifer is capable of producing the volume of water required. Information on groundwater availability can be obtained from the Manitoba Conservation, Water Resources Branch. In some cases, test drilling may be required to determine if an aquifer is present and could provide the required amount of water. The quality of this groundwater should also be investigated. In some parts of the province, groundwater may be sufficiently saline (or contain high concentrations of some constituents) to limit its quality or suitability for drinking water purposes.

SECTION 7 DEAD ANIMAL DISPOSAL

Disposal of dead livestock must be in accordance with section 15 of the Livestock Manure and Mortalities Management Regulation (Appendix B). This section describes the four methods allowed by the regulations for disposing of mortalities. This regulation specifies that mortalities must be kept in a secure storage location or room. If not disposed of within 48 hours of the time of death, mortalities must be refrigerated or frozen. Mortalities have to be stored in a location preventing access by scavenger animals such as coyotes, wolves, dogs or birds. Disposal is specified to be by delivery to a rendering plant, burial, composting or incineration.



Container for temporary storage of mortalities

7.1 RENDERING

Rendering companies often accept only limited volumes of poultry mortalities, as the presence of feathers complicates their processing. When available, delivery to a rendering company is probably the best solution for disposal. Rendering companies may have certain restrictions regarding the condition of the carcasses they process. In general, the carcasses should be brought in as quickly as possible in summer. Animals that die during the winter can be frozen and delivered to the renderer at periodic convenient intervals.

However, rendering is not the prevalent means of disposing of poultry mortalities in Manitoba. Refer to the telephone yellow pages directory under Rendering Companies to inquire about companies providing this service.

7.2 BURIAL

Burial is a suitable practice for summer. Dead animals can be placed in a trench, which is then backfilled each time a carcass is added. Depending upon soil conditions, however, decomposition can be very slow, with carcasses remaining intact for five years or more. Caution is therefore required for burial of dead animals. The burial site should be at least 100 m (328 ft) from a watercourse, sinkhole, springs or from any source of water used for domestic purposes. Areas with a high groundwater level or shallow aquifers must be avoided. Carcasses must be covered with at least one metre (3 ft) of soil.

During the winter it is advisable to put carcasses in a holding area such as a covered trailer, where they can remain frozen until burial is possible in the spring. The carcasses should be protected from scavengers. If left unprotected, scavengers

Rendering companies will often offer pickup service for mortalities, right at the farm gate

will drag the carcasses around, creating both a nuisance and a possible health hazard. For small birds, it may be practical to store the carcasses in a freezer until the numbers are sufficient to justify delivery to a rendering plant or burial.

While at one time carcasses could be brought to sanitary landfills, this is no longer possible in many areas. Municipalities that bury their refuse on a daily basis may allow animals to be deposited in landfill sites. Check with your local municipal office to determine if this is allowed in your area.

7.3 COMPOSTING

Composting is becoming an increasingly popular method of disposing of dead animals in the more moderate climates in the U.S.A. and, in particular, for disposing of poultry mortalities. This method has recently been introduced and is now practised in a few broiler facilities in Manitoba.

This technique is particularly well adapted to the needs of broiler facilities. Most often, in-barn composters are installed directly in these facilities, where winter temperatures do not complicate the efficacy of the composting process. In-barn composters will typically contain a volume of approximately 1 m^3 (1.3 cubic yard) allowing for handling with front-end loading equipment. In-barn composters are taken outside to be emptied at cleanout time, which aerates the compost for the second stage of the composting process.

In-barn composters are very practical for broiler operations

The composting process is continued after in-barn composters are emptied into windrows

Ideally, the compost is placed in windrows.

Operations utilizing composting of mortalities must be designed and managed in such a way that they do not cause pollution. Composting sites should be located at least 100 m (328 ft) from a watercourse, sinkhole, springs or any source of water used for domestic purposes.

Location of a composter should take the farm residence and any neighbouring residences into account. While offensive odours are not usually generated in the composting process, the handling of dead livestock and compost on a daily basis may not be aesthetically pleasing. When locating compost windrows, consideration should be given to traffic patterns required for removing finished compost from the composter. The composter site should be well drained and provide all-weather access roads and work areas.

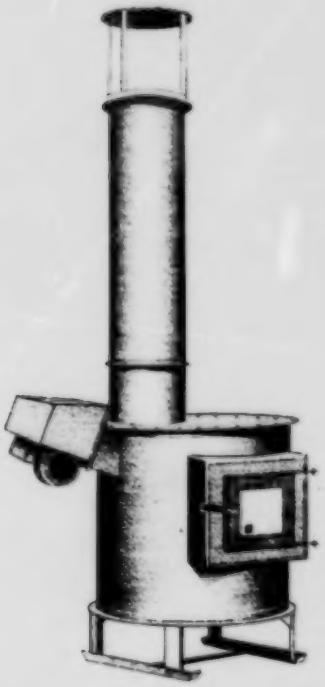
For more information on composting of poultry, contact your regional agricultural engineer or the Animal Industry Branch of Manitoba Agriculture and Food.

7.4 INCINERATION

Incineration is an acceptable method of disposal if performed properly. To burn dead animals without creating an odour problem, the temperature of the incinerator must be sufficiently high. Incineration requires

a large amount of energy to completely cremate a carcass. A number of commercial incinerators are specifically designed for dead-poultry disposal.

The installation and operation of the incinerator must be in compliance with Manitoba's Incinerators Regulation MR 91/88, under The Environment Act.



Incinerators are commercially available for disposing of poultry mortalities

SECTION 8 PREPARING A LIVESTOCK OPERATION PROPOSAL

The planning should begin many months prior to building facilities

8.1 PUBLIC CONTROVERSY

The establishment of a new livestock operation is increasingly dependent on the proponents' ability to build public understanding and support.

The development of a livestock operation can generate opposition and controversy for several reasons.

- Modern communication technology has made people more aware of worldwide problems, and in turn, more anxious about development closer to home. People who were once willing to accept some negatives as the price of progress may now be suspicious of any type of resource development. They may feel that the only way to prevent a negative impact is to demand that there be no change at all.
- People resist change if they don't understand the goals, methods, sponsors or timing of a proposed change.
- Proponents of a project may fail to communicate with the various groups who may approve, support, fear or oppose change. Few opportunities are provided for citizens to participate constructively in plans and decisions that may affect the local community.
- Project managers usually decide, act on and defend project plans. While the technical design may be conducted in a rational, scientific and professional manner, public relations may be ad hoc or non-existent.
- Perception of livestock operations may be based on bad experiences with poorly managed operations.

8.1.1 Thoughts for change

A participative planning process can provide opportunities for input by all those who may be affected by the proposal, and thus build local understanding and support for a project. This process could lead to developing desirable aspects of the project not thought of by the proponent.

Rural communities are less and less populated by residents depending solely on agriculture. The expectations and concerns of rural residents often lead to questions on the potential impacts and benefits of livestock operation projects. These apprehensions are usually fuelled by a lack of information as to how a proposed operation will mitigate pollution and odour concerns. While many welcome the diversification of agriculture in their region, the statement is often made that "the public is against a project"; in fact only a portion of the public may be opposed.

An open dialog with the future neighbours of a proposed livestock operation will always provide positive results. Giving people the opportunity to participate and express concerns can build acceptance, understanding and trust, and may result in

changes that lead to a better project. By informing and involving rural residents, a broad base of support can be developed.

8.1.2 Public understanding

A number of tools are available to build public understanding and support. Familiarize yourself with local bylaws or special requirements within the municipality or planning district. Depending on the size of the planned operation, some or all of the following tools are appropriate.

- **Building a social profile** - Assess the people who are likely to have an interest in your project. Do your neighbours feel they will be affected? How about suppliers in nearby areas, or people who might service your project? Will some people gain employment, will tax rolls benefit, will roads be serviced? Will environmental groups or nearby home owners oppose the project? Make your list of the various publics and their perspectives and concerns. Design an approach for addressing the concerns of each group.

- **Personal contact** - Ask for your neighbours' opinions on your proposed plan. If they have concerns, acknowledge them and indicate that you will do your best to address those concerns. Promise further discussion when you have more information. Get more information to address concerns; or if feasible, alter plans to accommodate their concerns. Provide informative pictures, videos or field trips to similar operations to reduce concerns and build a level of comfort.

- **Responsive publication** - In some instances, a wide range of people in a community who may be affected can be contacted through a mailout or newspaper announcement. Include a response form that provides for the identification of the person responding. Concerns can be addressed very effectively in this manner.

- **Open house** - A positive way to allow the public to learn about the project and express their concerns is through an open house. These events are an effective method of communication. Proponents should prepare posters that describe their project, provide staff to answer questions, and arrange for representation from involved government agencies. Provide data that demonstrate that the project meets all government requirements and regulations. These include municipal bylaws, provincial requirements under various acts or regulations such as The Planning Act, The Water Rights Act or the Livestock Manure and Mortalities Management Regulation.

  Ensure that the project meets the minimum suggested criteria set out in the Farm Practices Guidelines. Provide a timetable that outlines projected completion dates for various aspects of the proposal. Include ample time for the public consultation process.

  An open house can be held in a local hall. Hours should be convenient to allow people to come and go at their leisure. Questionnaires should be available to ensure feedback. Encourage visitors to fill out the questionnaires, leaving phone numbers so follow-up can be conducted. Ensure that adequate staff are available so that visitors can get answers to most, if not all, of their questions.

- **The planning workshop** - Bringing together representatives of concerned groups such as the citizen groups, special-interest groups and relevant government departments with a skilled workshop leader may be a way to address concerns, develop alternatives and eliminate roadblocks to approval. This is more likely to be successful when a broad base of people will benefit from the proposal.

- **A reference centre** - Make a place available, such as the municipal office or library, where technical documents related to the project are available for public scrutiny. These documents may include blueprints, artist sketches, technical data like well logs, aquifer locations or other technical reports. This shows openness and helps prevent false accusations.

- **Informal consultations** - Keep both the formal and informal leaders up-to-date on project developments to avoid surprises.

8.2 TECHNICAL REVIEW PROCESS FOR INTENSIVE LIVESTOCK OPERATION

The purpose of the Technical Review Process is to provide support to local governments when they are asked to review an application for a livestock operation project and assist with the exchange of information between the proponent, municipal council(s) and rural residents. Technical Review Committees were established to provide local governments with a technical review of the project proposal of a proponent of livestock operations. This review is based on:

- local and provincial land use policies;
- the Farm Practices Guidelines for various livestock commodities in Manitoba;
- environmental regulations (in particular the Livestock Manure and Mortalities Management Regulation);
- other provincial regulations;
- other available information as deemed appropriate by the committee.

The Technical Review Committee consists of professionals from the provincial departments of Agriculture and Food, Conservation and Intergovernmental Affairs. The regional director of Manitoba Agriculture and Food chairs this committee.

The final written report will be provided to the local government agency and the proponent. This final report addresses land use issues, siting and location factors, and groundwater and surface water issues.

8.2.1 Process of a technical review

A technical review will begin when the Regional Director of Manitoba Agriculture and Food receives a written request from a municipal council. The request must be accompanied by a completed Livestock Production Operation Information Review form. This form is reproduced in Appendix H. Proponents are encouraged to seek the assistance of an agricultural engineer in the preparation of the form.

Reviews are suggested for all livestock operations in excess of 400 animal units. Reviews for operations of fewer than 400 animal units are at the discretion of the municipal council and the proponent.

8.2.2 Public access to the report

Copies of the final report are available to the public upon written request following the first council meeting after receipt of the final report by the municipal council. This is to ensure that all council members have had an opportunity to review the final report before it is released to the public.

8.3 LAND BASE REQUIREMENTS FOR MANURE APPLICATION

When preparing a proposal, a proponent will need to approximate the land base required to be able to apply the manure for a proposed size of operation at a rate matching anticipated crop nitrogen requirements. Tables 14 to 17 below provide the parameters to be accounted for and a method for estimating this land base. This method utilizes values for:

- the amount of nitrogen produced for various types of operations based on research results using either the

nitrogen production or feed consumption methods (see Appendix I);

- assumed averaged losses under various storage and application methods (see Appendix E);
- crop nitrogen utilization under general soil types.

Generally, this method provides a conservative approximation of land required for spreading manure and is recommended for planning purposes at the proposal stage.

Layout of a proposed operation and fields identified for land application of manure on a rural municipality property ownership map.

TABLE 14: NITROGEN STORAGE AND APPLICATION FACTOR

Storage Method	Application Method			
	Injection	Broadcast and Incorporate Within 48 Hours	Broadcast	Sprinkler
I. Liquid Manure Systems				
Enclosed	0.83	0.81	0.64	0.60
Open (except Earthen)	0.78	0.76	0.60	0.56
Earthen	0.59	0.57	0.45	0.42
II. Solid Manure Systems				
Daily Scrape		0.71	0.60	
Manure Pack		0.67	0.56	
Open Lot		0.48	0.40	

TABLE 15: SOIL AND CROP NITROGEN UTILIZATION (METRIC UNITS)[1]

Type of Crop	Nitrogen Utilization (kg/ha)	Soil and Crop Nitrogen[2] Utilization Factor	
		Spring Application	Fall Application
Forages, Established Stands:			
Alfalfa	250	0.29	0.23
Grasses	165	0.43	0.35
Grass - Alfalfa Mixtures	195	0.37	0.30
Annual Crops:			
Medium to Heavy Soils	90	0.81	0.65
Light Soils	65	1.08	0.86

[1] Based upon annual applications.

[2] See Appendix C for imperial units.

TABLE 16: ANIMAL UNIT FACTOR

Livestock	Number of A.U. per Livestock[1]
Chickens	
Broilers	0.0050
Roasters	0.0100
Layers	0.0830
Pullets	0.0033
Broiler Breeder Pullets	0.0033
Broiler Breeder Hens	0.0100
Turkeys	
Broilers	0.0100
Heavy Toms	0.0200
Heavy Hens	0.0100

[1] Refers to livestock places or barn capacity.

TABLE 17: LAND BASE REQUIRED[1] FOR MANURE APPLICATION, HECTARES[2]

STEP 1:	Determine the total number of animal units produced by the livestock operation. Simply multiply the number of livestock places or barn capacity by the A.U. values in Table 17.		
STEP 2:	Determine the factor for the type of storage and application method, Table 15.		
STEP 3:	Determine the soil and crop utilization factor based upon the soil type, crop and time of application, Table 16.		
STEP 4:	Enter the number of days per year that the livestock production operation is occupied.		
STEP 5:	Multiply the number of animal units produced (Step 1) by the factors in Steps 2, 3 and 4 to determine the number of hectares required to utilize the manure from the feeding location.		
STEP 1:	Number of Livestock	_____	(A)
	Animal Unit Factor (Table 17)	_____	(B)
	Total Animal Units (A x B)	_____	(C)
STEP 2:	Storage and Application Factor (Table 15)	_____	(D)
STEP 3:	Soil and Crop Nitrogen Utilization Factor (Table 16)	_____	(E)
STEP 4:	Days in Feeding Location	_____	(F)
STEP 5:	Hectares Required for Feeding Location (C x D x E x F ÷ 365)	_____	**ha**

[1]Note that the land base required may change annually as cropping practices change.

[2]See Appendix C for imperial units

Once an operation has been established, specific application rates need to be calculated for each field on the basis of soil and manure tests, and the specific crop requirements. Refer to Section 4 to find out how to develop a sound manure management plan. This will ensure that the manure is fully utilized as a valuable fertilizer.

8.4 RESOURCE INFORMATION

These guidelines present a summary of the information available on manure management. The selection of a manure management system involves a detailed analysis of an individual operation. Producers who are interested in obtaining more information on manure management should obtain the assistance of an agricultural engineer.

Manitoba Agriculture and Food staff are available for advice on odour control strategies and manure-management issues. A wide variety of resource information is available to proponents. Listed below are a number of these resources and their source.

- Municipal bylaws, special requirements within municipalities or Planning Districts
  - local Municipal Office
  - Regional Rural Development Offices

- Property Ownership Maps

  Re Pro Map Ltd.
  P.O. Box 299
  1550 Main Street
  Dauphin MB R7N 2V2
  Phone: 638-3584 Fax: 638-3386

- Air Photos - Map Sales

  Manitoba Conservation
  Century Industrial Plaza
  1007 Century Street
  Winnipeg MB R3H 0W4
  Phone: 945-6666
  1-800-282-8069 ext. 6666

- Well Drillers Reports,
  Aquifer information,
  Groundwater quality maps,
  Drainage maps,
  Pollution hazard maps,
  Groundwater appraisals

  Manitoba Conservation
  200 Saulteaux Crescent
  Winnipeg MB R3J 3W3
  Phone: 945-7420 Fax: 945-7419
  1-800-282-8069 ext. 7420

- Water Licensing Information

  Manitoba Conservation
  200 Saulteaux Crescent
  Winnipeg MB R3J 3W3
  Phone: 945-9424 Fax: 945-7419
  1-800-282-8069 ext. 9424

- Soil Survey Information

  Soil Survey Unit
  362 Ellis Building
  University of Manitoba
  University Crescent
  Winnipeg MB R3T 2N2
  Phone: 474-6108 Fax: 269-0322

- Manure Management Plan Registration form and advice on requirements

  Regional Manitoba Conversation office (see Appendix G for addresses)

- Building Permit near road allowances

  Manitoba Highways & Government Services
  Highway Planning & Design
  215 Garry St
  Winnipeg, MB R3C 3Z1
  Phone: 945-5658 Fax: 945-0593
  1-800-282-8069 ext. 5658

- Manure Application Rate Calculator software (MARC98)

  Animal Industry Branch
  Manitoba Agriculture and Food
  204-545 University Cr.
  Winnipeg, MB R3T 5S6
  Phone: 945-1642
  1-800-282-8069 ext. 1642

  Also available from Manitoba Agriculture and Food's Internet site (www.gov.mb.ca/agriculture/livestock as downloadable software.

8.4.1 Manitoba Agriculture and Food

Manitoba Agriculture and Food's extension service is a valuable source of information (see www.gov.mb.ca/agriculture). Regional agricultural engineers provide engineering advice related to livestock facilities design and manure management systems. Manitoba Agriculture and Food also employs specialists in animal science, soil science and crop production. Their recommendations are presented in numerous factsheets. The staff of Manitoba Agriculture and Food works cooperatively with other professionals across Canada and as a result have a wide range of publications and standard plans available on a variety of subjects. These services can be obtained by contacting the following offices:

Portage Regional Office
25 Tupper Street N
Portage la Prairie MB R1N 3K1
PH: 204-239-3364

Beausejour Regional Office
20 First Street S
Beausejour MB R0E 0C0
PH: 204-268-6011

Dauphin Regional Office
27 Second Avenue SW
Dauphin MB R7N 3E5
PH: 204-622-2020

Brandon Regional Office
1129 Queens Avenue
Brandon MB R7A 1L9
PH: 204-726-6408

Animal Industry Branch
204-545 University Crescent
Winnipeg MB R3T 5S6
PH: 204-945-7684
1-800-282-8069 ext. 7684

Soils and Crops Branch
65-3rd Avenue NE
Carman MB R0G 0J0
PH: 204-745-2040

Veterinary Services Branch
204-545 University Crescent
Winnipeg MB R3T 5S6
PH: 204-945-7643
1-800-282-8069 ext. 7643

8.4.2 Other resources

The Prairie Agricultural Machinery Institute has developed considerable expertise in manure management equipment; several research, development and evaluation reports are available. Agriculture and Agri-Food Canada and the Midwest Plan Service offer a variety of publications on manure management. Producers can contact the Prairie Farm Rehabilitation Administration for technical assistance on soil conservation matters and shelterbelt planting. Some research centres and associations offer reports and other information relevant to the same issues. For information on current publications contact the following offices:

Prairie Agricultural Machinery Institute
P.O.Box 1060
Portage la Prairie, MB R1N 3C5
Ph: 204-239-5445

Agriculture and Agri-Food Canada

Prairie Farm Rehabilitation Administration
Manitoba Region
200-303 Main Street
Winnipeg, MB R3C 3G7

PFRA – Beausejour District: 268-3233
PFRA – Brandon District: 726-7584
PFRA – Dauphin District: 638-6108
PFRA – Morden District: 822-7273

Pacific Agri-Food Research Centre
P.O. Box 1000
Agassiz, B.C. V0M 1A0
http://res.agr.ca/agassiz

Midwest Plan Service
122 Davidson Hall
Iowa State University
Ames, Iowa 50011

Manitoba Broiler Hatching Egg Commission
3489 Pembina Hwy
Winnipeg, MB R3V 1A4
Ph: 204-261-9679
Fax: 204-261-9680
e-mail: MBHEC@sympatico.ca

Manitoba Chicken Producer Board
430-A Dovercourt Drive
Winnipeg, MB R3Y 1N4
Ph: 204-489-4603
Fax: 204-489-4907
e-mail: chicken@chicken.mb.ca

Manitoba Egg Producers
18-5 Scurfield Blvd.
Winnipeg, MB R3Y 1G3
Ph: 204-488-4888
Fax: 204-488-3544
e-mail: info@mbegg.mb.ca

Manitoba Turkey Producers
430-A Dovercourt Drive
Winnipeg, MB R3Y 1N4
Ph: 204-489-4635
Fax: 204-489-4907
e-mail: mbturkey@turkey.mb.ca

In addition to the resources available through extension engineers and publications, private consultants specializing in agricultural engineering and manure management can also provide information and detailed designs for manure-handling systems.

CHAPTER F45

THE FARM PRACTICES PROTECTION ACT

TABLE OF CONTENTS

Section

1 Definitions
2 Protection from nuisance claims
3 Farm Practices Protection Board
4 Acting board members
5 Quorum
6 Procedure
7 Part V of Evidence Act powers
8 Studies and professional assistance
9 Applications
10 Investigation and resolution of dispute
11 Refusal to consider application
12 Decision
13 Appeal
14 Injunction proceedings in abeyance
15 Regulations
16 Consequential amendment
17 C.C.S.M. reference
18 Coming into force

(Assented to June 24, 1992)

HER MAJESTY, by and with the advice and consent of the Legislative Assembly of Manitoba, enacts as follows:

DEFINITIONS

Definitions

1 In this Act,

"agricultural operation" means an agricultural, aquacultural, horticultural or silvicultural operation that is carried on in the expectation of gain or reward, and includes

(a) the tillage of land,

(b) the production of agricultural crops, including hay and forages,

(c) the production of horticultural crops, including vegetables, fruit, mushrooms, sod,

CHAPITRE F45

LOI SUR LA PROTECTION DES PRATIQUES AGRICOLES

TABLE DES MATIÈRES

Article

1 Définitions
2 Protection contre les plaintes abusives
3 Commission de protection des pratiques agricoles
4 Membres intérimaires
5 Quorum
6 Procédure
7 Loi sur la preuve
8 Études et experts-conseils
9 Requête
10 Enquête et règlement du conflit
11 Refus d'examiner la requête
12 Décision
13 Appel
14 Suspension de la procédure d'injonction
15 Règlements
16 Modification corrélative
17 Codification permanente
18 Entrée en vigueur

(Date de sanction : 24 juin 1992)

SA MAJESTÉ, sur l'avis et avec le consentement de l'Assemblée législative du Manitoba, édicte :

DÉFINITIONS

Définitions

1 Les définitions qui suivent s'appliquent à la présente loi.

« **Commission** » La Commission de protection des pratiques agricoles constituée en vertu de l'article 3. ("board")

« **exploitation agricole** » Exploitation agricole, aquicole, horticole ou sylvicole poursuivie dans l'attente d'un gain ou d'une rétribution. La présente définition inclut :

a) le labourage du sol;

trees, shrubs and greenhouse crops,

(d) the raising of livestock, including poultry,

(e) the production of eggs, milk and honey,

(f) the raising of game animals, fur-bearing animals, game birds, bees and fish,

(g) the operation of agricultural machinery and equipment,

(h) the process necessary to prepare a farm product for distribution from the farm gate,

(i) the application of fertilizers, manure, soil amendments and pesticides, including ground and aerial application, and

(j) the storage, use or disposal of organic wastes for farm purposes; (« exploitation agricole »)

"board" means the Farm Practices Protection Board established under section 3; (« Commission »)

"court" means the Court of Queen's Bench; (« tribunal »)

"land use control law" means any Act of the Legislature, regulation, plan or by-law that restricts or prescribes the use to which land or premises may be put or the nature of business or activities that may be carried on on any land or premises; (« loi de réglementation en matière d'utilisation du sol »)

"minister" means the member of the Executive Council charged by the Lieutenant Governor in Council with the administration of this Act; (« ministre »)

"normal farm practice" means a practice that is conducted

(a) in a manner consistent with proper and accepted customs and standards as established and followed by similar agricultural operations under similar circumstances, including the use of innovative technology used with advanced management practices, and

(b) in conformity with any standards set out in the regulations; (« pratique agricole normale »)

b) la production de récoltes agricoles, y compris le foin et les fourrages;

c) la production de récoltes horticoles, y compris les légumes, les fruits, les champignons, le gazon, les arbres, les arbustes et les récoltes de serre;

d) l'élevage de bétail, notamment de volaille;

e) la production d'oeufs, de lait et de miel;

f) l'élevage de gibier, d'animaux à fourrure, de gibier à plumes, d'abeilles et de poissons;

g) le maniement de machines et de matériel agricoles;

h) le traitement nécessaire pour la préparation d'un produit agricole en vue de sa distribution depuis la ferme;

i) l'épandage d'engrais, de fumier, d'amendements et de pesticides, y compris la pulvérisation au sol et la pulvérisation aérienne;

j) le stockage, l'utilisation ou l'élimination de déchets organiques à des fins agricoles. ("agricultural operation")

« loi de réglementation en matière d'utilisation du sol » *Loi de l'Assemblée législative*, règlement, plan ou règlement municipal qui restreint ou prescrit, à l'égard d'un sol ou de locaux, l'utilisation qui peut en être faite ou la nature des entreprises qui peuvent y être exploitées ou des activités qui peuvent y être exercées. ("land use control law")

« ministre » Le membre du Conseil exécutif chargé par le lieutenant-gouverneur en conseil de l'application de la présente loi. ("minister")

« personne » S'entend notamment d'une association de personnes sans personnalité morale, d'une société en nom collectif ou d'une coopérative. ("person")

« pratique agricole normale » Pratique exercée :

a) d'une part, selon des coutumes et des normes reconnues appropriées, établies et respectées à l'égard d'exploitations agricoles comparables dans des circonstances similaires, y compris le recours à des technologies novatrices associées à une gestion moderne;

"person" includes an unincorporated association, partnership or cooperative. (« personne »)

b) d'autre part, en conformité avec les normes réglementaires. ("normal farm practice")

« tribunal » La Cour du Banc de la Reine. ("court")

PROTECTION FROM NUISANCE CLAIMS

Protection from nuisance claims
2(1) A person who carries on an agricultural operation, and who, in respect of that operation,

(a) uses normal farm practices; and

(b) does not violate

(i) a land use control law,

(ii) *The Environment Act* or a regulation or order made under that Act, or

(iii) *The Public Health Act* or a regulation or order made under that Act;

is not liable in nuisance to any person for any odour, noise, dust, smoke or other disturbance resulting from the agricultural operation, and shall not be prevented by injunction or other order of a court from carrying on the agricultural operation because it causes or creates an odour, noise, dust, smoke or other disturbance.

Protection continues despite change in by-law, etc.
2(2) Subsection (1) applies notwithstanding the occurrence of one or more of the following:

(a) the land use by-law of the municipality in which the agricultural operation is carried on changes or the agricultural operation becomes a non-conforming use;

(b) the ownership of the land on which the agricultural operation is carried on changes;

(c) the agricultural operation is carried on by other persons;

(d) the use of land near to the land on which the agricultural operation is carried on changes.

PROTECTION CONTRE LES PLAINTES ABUSIVES

Protection contre les plaintes abusives
2(1) La personne qui poursuit une exploitation agricole est dégagée de toute responsabilité en nuisance pour tout dérangement, y compris l'odeur, le bruit, la poussière ou la fumée, causé par l'exploitation agricole si elle :

a) a recours à des pratiques agricoles normales;

b) n'enfreint aucun des textes suivants :

(i) les lois de réglementation en matière d'utilisation du sol,

(ii) la *Loi sur l'environnement* et ses règlements et décrets d'application,

(iii) la *Loi sur la santé publique* et ses règlements et décrets d'application.

De plus, le tribunal ne peut prononcer contre cette personne aucune injonction ni rendre aucune ordonnance visant à l'empêcher de poursuivre l'exploitation agricole pour le motif que celle-ci cause un tel dérangement.

Maintien de la protection
2(2) Le paragraphe (1) s'applique malgré la survenance d'un ou de plusieurs des événements suivants :

a) le règlement qui régit l'utilisation du sol et qui est pris par la municipalité dans laquelle l'exploitation agricole est poursuivie est modifié ou l'exploitation agricole devient une utilisation non conforme;
b) le propriétaire du sol sur lequel l'exploitation agricole est poursuivie change;

c) l'exploitation agricole est poursuivie par d'autres personnes;

d) l'utilisation du sol près de celui sur lequel l'exploitation agricole est poursuivie change.

L.M. 1994, c. 20, art. 7; L.M. 1997, c. 30, art. 2

FARM PRACTICES PROTECTION BOARD

Farm Practices Protection Board established
3(1) The "Farm Practices Protection Board" is established and shall consist of not less than three members appointed by the Lieutenant Governor in Council.

Chairperson and vice-chairperson
3(2) The Lieutenant Governor in Council shall designate one of the members of the board as chairperson and another as vice-chairperson.

Duties of chairperson
3(3) The chairperson is responsible for the general supervision and direction of the conduct of the affairs of the board and, if he or she is absent or unable to act, the vice-chairperson shall have the powers of the chairperson.

Term of members
3(4) The members of the board shall be appointed for a term not exceeding four years and may be re-appointed, but no member shall hold office for more than eight years, whether the appointments are for consecutive terms or not.

Remuneration and expenses
3(5) The members of the board shall be paid such remuneration and receive such expenses as the Lieutenant Governor in Council determines.

Acting board members
4(1) The minister may from time to time nominate one or more persons from among whom acting members of the board may be selected.

Selection of acting board members
4(2) When in the opinion of the chairperson it is necessary or desirable for the proper performance of the board's duties, the chairperson may select not more than three persons nominated under subsection (1) as acting members of the board for a period of time or for the purpose of any matter before the board.

Powers and duties of acting member
4(3) An acting member has and may exercise and perform the powers and duties of a member of the board.

Remuneration and expenses
4(4) An acting member is entitled to be paid such remuneration and receive such expenses as the minister determines.

COMMISSION DE PROTECTION DES PRATIQUES AGRICOLES

Constitution de la Commission
3(1) Est constituée la Commission de protection des pratiques agricoles, composée d'au moins trois membres nommés par le lieutenant-gouverneur en conseil.

Président et vice-président
3(2) Le lieutenant-gouverneur en conseil désigne le président et le vice-président parmi les membres de la Commission.

Fonctions du président
3(3) Le président est chargé de la direction générale des affaires de la Commission. En cas d'absence ou d'empêchement du président, le vice-président est investi de ses pouvoirs.

Mandat
3(4) Les membres de la Commission sont nommés pour un mandat maximal de quatre ans et peuvent recevoir un nouveau mandat. Toutefois, aucun membre ne peut occuper son poste pendant plus de huit ans, que ses mandats soient consécutifs ou non.

Rémunération et indemnités
3(5) Les membres de la Commission reçoivent la rémunération et les indemnités que fixe le lieutenant-gouverneur en conseil.

Membres intérimaires
4(1) Le ministre peut présenter une ou plusieurs personnes parmi lesquelles les membres intérimaires de la Commission peuvent être choisis.

Choix des membres intérimaires
4(2) Le président peut choisir au plus trois des personnes présentées en application du paragraphe (1) afin qu'elles agissent à titre de membres intérimaires de la Commission pour une période ou aux fins de l'étude d'une question dont la Commission est saisie, s'il estime qu'il est nécessaire ou souhaitable de le faire pour l'accomplissement efficace des fonctions de celle-ci.

Pouvoirs et fonctions des membres intérimaires
4(3) Les membres intérimaires ont les pouvoirs et les fonctions des membres de la Commission.

Rémunération et indemnités
4(4) Les membres intérimaires ont droit à la rémunération et aux indemnités fixées par le ministre.

Quorum
5 Three members of the board, of whom at least two are members appointed under subsection 3(1), constitute a quorum and are sufficient for the exercise of all of the jurisdiction and powers of the board.

Procedure
6 The board may determine its own practice and procedure but shall give full opportunity to the parties to present information and make representations.

Part V of Evidence Act powers
7 The members of the board have the powers of commissioners under Part V of *The Manitoba Evidence Act*.

Board to conduct studies
8(1) The minister may direct the board to study any matter related to farm practices and the board shall conduct the study and report its findings and recommendations to the minister.

Professional assistance
8(2) The board may appoint one or more persons having technical or special knowledge of any matter to assist the board in any capacity in respect of a matter before it.

Quorum
5 Le quorum est constitué par trois membres de la Commission, dont deux au moins sont nommés en vertu du paragraphe 3(1).

Procédure
6 La Commission peut régir sa propre procédure, mais elle est tenue de donner aux parties l'occasion de présenter des renseignements et des observations.

Loi sur la preuve
7 Les membres de la Commission ont les pouvoirs des commissaires nommés en vertu de la partie V de la *Loi sur la preuve au Manitoba*.

Études effectuées par la Commission
8(1) Le ministre peut ordonner à la Commission d'étudier toute question relative à des pratiques agricoles; la Commission effectue l'étude et présente au ministre ses conclusions et ses recommandations.

Experts-conseils
8(2) La Commission peut nommer une ou plusieurs personnes ayant des connaissances techniques ou spéciales pour la seconder de quelque manière que ce soit sur toute question dont elle est saisie.

COMPLAINTS

Application for determination
9(1) A person who is aggrieved by any odour, noise, dust, smoke or other disturbance resulting from an agricultural operation may apply in writing to the board for a determination as to whether the disturbance results from a normal farm practice.

Contents of application
9(2) An application under subsection (1) shall contain a statement of the nature of the complaint, the name and address of the person making the application and the name and address of the agricultural operation, and shall be in a form acceptable to the board.

Notices
9(3) The board may require that an applicant give written notice, in such form and manner that the board specifies, to the persons that the board specifies.

PLAINTES

Requête
9(1) Toute personne lésée par un dérangement causé par une exploitation agricole, y compris une odeur, un bruit, de la poussière ou de la fumée, peut demander par écrit à la Commission de déterminer si le dérangement résulte d'une pratique agricole normale.

Contenu de la requête
9(2) La requête visée au paragraphe (1) est présentée sous une forme satisfaisante pour la Commission et énonce la nature de la plainte, ainsi que le nom et l'adresse du requérant et de l'exploitation agricole.

Avis
9(3) La Commission peut exiger que le requérant avise par écrit les personnes qu'elle désigne. Elle précise la forme de l'avis et les modalités de sa remise.

Parties
9(4) The parties to an application are the applicant, the owner or operator of the agricultural operation and any person added as a party by the board.

No action commenced unless application made
9(5) A person shall not commence an action in nuisance for any odour, noise, dust, smoke or other disturbance resulting from an agricultural operation unless the person has, at least 90 days previously, applied to the board under this section for a determination as to whether the disturbance complained of results from a normal farm practice.

Subsequent nuisance action not required
9(6) A person may apply to the board for a determination under this section whether or not an action in nuisance is subsequently commenced.

Investigation and resolution of dispute
10 On receiving an application, the board may inquire into and endeavour to resolve a dispute between the aggrieved person and the owner or operator of the agricultural operation and may determine what constitutes a normal farm practice in respect of that agricultural operation.

Refusal to consider application
11(1) The board may refuse to consider an application or to make a decision if in its opinion,

(a) the subject-matter of the application is trivial;

(b) the application is frivolous or vexatious or is not made in good faith; or

(c) the applicant does not have a sufficient personal interest in the subject-matter of the application.

Decision given to parties
11(2) The board shall notify the parties of its refusal to consider an application or to make a decision under subsection (1), and give them written reasons for its action.

Decision of the board
12(1) If the board is unable to resolve the dispute between the aggrieved person and the owner or operator of the agricultural operation, the board shall

(a) dismiss the complaint if the board is of the opinion that the disturbance complained of results from a normal farm practice; or

Parties
9(4) Sont parties à la requête le requérant, le propriétaire ou l'exploitant de l'exploitation agricole et toute personne qu'ajoute la Commission.

Condition préalable à l'introduction d'une action
9(5) Une personne ne peut introduire une action en nuisance pour tout dérangement, y compris l'odeur, le bruit, la poussière ou la fumée, causé par une exploitation agricole que si elle a, au moins 90 jours avant l'introduction de l'action, demandé à la Commission, conformément au présent article, de déterminer si le dérangement faisant l'objet de la plainte résulte d'une pratique agricole normale.

Action en nuisance ultérieure
9(6) Une personne peut demander à la Commission de rendre une décision sous le régime du présent article, même si aucune action en nuisance n'est introduite ultérieurement.

Enquête et règlement du conflit
10 Saisie d'une requête, la Commission peut enquêter sur le conflit qui existe entre la personne lésée et le propriétaire ou l'exploitant de l'exploitation agricole, s'efforcer de régler ce conflit et déterminer ce qui constitue une pratique agricole normale à l'égard de l'exploitation agricole.

Refus d'examiner la requête
11(1) La Commission peut refuser d'examiner la requête ou de rendre une décision si elle est d'avis :

a) soit que l'objet de la requête est futile;

b) soit que la requête est frivole ou vexatoire ou n'est pas présentée de bonne foi;

c) soit que l'intérêt du requérant dans l'objet de la requête n'est pas suffisant.

Avis de la décision
11(2) La Commission avise les parties de son refus d'étudier une demande ou de prendre une décision en application du paragraphe (1) et leur donne les motifs écrits de son refus.

Décision de la Commission
12(1) Si elle ne peut régler le conflit qui existe entre la personne lésée et le propriétaire ou l'exploitant de l'exploitation agricole, la Commission :

a) rejette la plainte si elle est d'avis que le dérangement qui en fait l'objet résulte d'une pratique agricole normale;

(b) order the owner or operator of the agricultural operation to cease the practice causing the odour, noise, dust, smoke or other disturbance if it is not a normal farm practice or to modify the practice in the manner set out in the order to be consistent with normal farm practices.

Decision given to parties
12(2) The board shall give a copy of its decision to each of the parties together with written reasons for the decision.

Decision shall be considered by court
12(3) A decision of the board under this section respecting an agricultural operation shall be considered by the court in any subsequent action in nuisance taken in respect of that operation.

Order of board may be filed in court
12(4) Where a person has failed to comply with an order of the board made under subsection (1) and the time for an appeal against the order has expired, the board may file a copy of the order, certified by the chairperson or secretary of the board to be a true copy, in court.

Board may apply to court
12(5) Upon filing under subsection 12(4), the order shall be deemed to be a judgment of the court in favour of the board and the board may apply to a judge of the court for an order requiring the person to comply with the judgment and the judge may also make one or more of the following orders:

(a) a contempt order against the person;

(b) an order respecting costs;

(c) any other order that may be necessary to give effect to the judgment or that the judge considers just.

S.M. 1997, c. 30, s. 3.

Appeal
13 Any party to an application may appeal an order of the board on a question of law to the court within 30 days after the making of the order.

Injunction proceedings in abeyance
14(1) When an agricultural operation is the subject of an application under subsection 9(1), no injunction proceedings may be commenced or continued in respect of that agricultural operation until the board has made a decision under subsection 12(1) or has refused to hear the application.

b) ordonne au propriétaire ou à l'exploitant de l'exploitation agricole, soit de cesser la pratique qui cause le dérangement si elle ne constitue pas une pratique agricole normale, soit de modifier la pratique de la manière énoncée dans l'ordonnance de façon à la rendre conforme à une pratique agricole normale.

Remise de la décision aux parties
12(2) La Commission remet aux parties une copie de sa décision accompagnée des motifs écrits de celle-ci.

Prise en considération de la décision
12(3) Le tribunal prend en considération la décision que rend la Commission à l'égard d'une exploitation agricole dans toute action en nuisance ultérieure introduite à l'égard de la même exploitation.

Dépôt de l'ordonnance de la Commission
12(4) Lorsqu'une personne fait défaut de se conformer à une ordonnance de la Commission rendue en vertu du paragraphe (1) et que le délai pour en appeler de cette ordonnance est expiré, la Commission peut déposer devant le tribunal une copie, certifiée conforme par le président ou le secrétaire, de l'ordonnance.

Ordonnance
12(5) L'ordonnance déposée en vertu du paragraphe 12(4) est réputée être un jugement du tribunal en faveur de la Commission et celle-ci peut en saisir un juge du tribunal en vue d'obtenir une ordonnance enjoignant à la personne de se conformer au jugement. Le juge peut également rendre l'une ou plusieurs des ordonnances suivantes :

a) une ordonnance pour outrage au tribunal;

b) une ordonnance relative aux frais et dépens;

c) toute autre ordonnance qui est nécessaire pour donner effet au jugement ou qu'il juge indiquée.

L.M. 1997, c. 30, art. 3.

Appel
13 Toute partie à une requête peut interjeter appel d'une ordonnance de la Commission au tribunal sur une question de droit dans les 30 jours suivant la date de l'ordonnance.

Suspension de la procédure d'injonction
14(1) Si une exploitation agricole fait l'objet d'une requête en vertu du paragraphe 9(1), aucune procédure d'injonction ne peut être entamée ni poursuivie à l'égard de cette exploitation agricole tant que la Commission n'a pas rendu une décision en application du paragraphe 12(1) ou n'a pas refusé d'entendre la requête.

Exception
14(2) Subsection (1) does not apply to proceedings taken under *The Environment Act* or *The Public Health Act*.

Exception
14(2) Le paragraphe (1) ne s'applique pas aux procédures entamées en vertu de la *Loi sur l'environnement* ou de la *Loi sur la santé publique*.

GENERAL PROVISIONS

DISPOSITIONS GÉNÉRALES

Regulations
15 The Lieutenant Governor in Council may make regulations

(a) prescribing fees payable in respect of an application made under subsection 9(1);

(b) respecting the nomination and selection of acting members of the board;

(c) respecting standards for the purpose of the definition of "**normal farm practice**";

(c.1) respecting matters that the board must have regard to in determining what constitutes a normal farm practice for agricultural operations;

(d) respecting any other matter or thing necessary or advisable for carrying out the purposes of this Act.

S.M. 1997, c. 30, s. 4.

Règlements
15 Le lieutenant-gouverneur en conseil peut, par règlement :

a) fixer les droits payables à l'égard des requêtes présentées en application du paragraphe 9(1);

b) prendre des mesures concernant la présentation et le choix des membres intérimaires de la Commission;

c) prendre des mesures concernant des normes pour l'application de la définition de « **pratique agricole normale** »;

c.1) prendre des mesures concernant les questions dont la Commission doit tenir compte au moment de déterminer ce qui constitue une pratique agricole normale pour les exploitations agricoles;

d) prendre toute autre mesure nécessaire ou souhaitable pour l'application de la présente loi.

L.M. 1997, c. 30, art. 4.

16 NOTE: This section contained consequential amendments to *The Nuisance Act*, which are now included in that Act.

16 NOTE : Les modifications corrélatives que contenait l'article 6 ont été intégrées à la *Loi sur les nuisances* à laquelle elles s'appliquaient.

C.C.S.M. reference
17 This Act may be cited as *The Farm Practices Protection Act* and referred to as chapter F45 of the *Continuing Consolidation of the Statutes of Manitoba*.

Codification permanente
17 La présente loi peut être citée sous le titre : *Loi sur la protection des pratiques agricoles*. Elle constitue le chapitre F45 de la *Codification permanente des lois du Manitoba*.

Coming into force
18 This Act comes into force on a day fixed by proclamation.

NOTE: S.M. 1992, c. 41 was proclaimed in force January 31, 1994.

Entrée en vigueur
18 La présente loi entre en vigueur à la date fixée par proclamation.

NOTE : Le chapitre 41 des *L.M. 1992* est entré en vigueur par proclamation le 31 janvier 1994.

THE ENVIRONMENT ACT
(C.C.S.M. c. E125)

Livestock Manure and Mortalities Management Regulation

Regulation 42/98
Registered March 30, 1998

LOI SUR L'ENVIRONNEMENT
(c. E125 de la C.P.L.M.)

Règlement sur la gestion des animaux morts et des déjections du bétail

Règlement 42/98
Date d'enregistrement : le 30 mars 1998

TABLE OF CONTENTS

Section

1 Interpretation
2 Purpose
3 Storage methods
4 Size and operation of manure storage facility
5 Location of manure storage facility
6 Permit required for manure storage facility
7 Field storage
8 Composting
9 Transportation
10 Reportable spills
11 No discharge into water
12 Allowable application to land
13 Manure management plans
14 Prohibitions on winter spreading
15 Disposal of mortalities
16 Confined areas
17 Variation of requirements
18 Review
19 Repeal

TABLE DES MATIÈRES

Article

1 Définitions
2 Objet
3 Méthodes de stockage
4 Dimensions et utilisation de l'installation de stockage de déjections
5 Emplacement de l'installation de stockage de déjections
6 Permis
7 Stockage dans les champs
8 Compostage
9 Transport
10 Déversement – déclaration
11 Rejet dans l'eau
12 Épandage autorisé
13 Plan de gestion des déjections du bétail
14 Interdiction – épandage d'hiver
15 Élimination des animaux morts
16 Espace clos
17 Modification des exigences
18 Révision
19 Abrogation

Schedule A Siting and Construction Requirements for Manure Storage Facilities

Schedule B Setback Requirements for Winter Spreading of Livestock Manure

Annexe A Exigences en matière d'emplacement et de construction des installationsde stockage des déjections du bétail

Annexe B Exigences relatives aux distances pour l'épandage des déjections du bétail en hiver

Interpretation

1(1) In this regulation,

"**agricultural operation**" means an agricultural, aquacultural, horticultural or silvicultural operation that is carried on in the expectation of gain or reward, and includes

(a) the tillage of land,

(b) the production of agricultural crops, including hay and forages,

(c) the production of horticultural crops, including vegetables, fruit, mushrooms, sod, trees, shrubs and greenhouse crops,

(d) the raising of livestock,

(e) the production of eggs, milk and honey,

(f) the raising of game animals, fur-bearing animals, game birds, bees and fish,

(g) the operation of agricultural machinery and equipment,

(h) the process necessary to prepare a farm product for distribution from the farm gate,

(i) the application of fertilizers, manure, soil amendments and pesticides, including ground and aerial application, and

(j) the storage, use or disposal of organic wastes for farm purposes; (« exploitation agricole »)

"**animal unit**" means the number of animals of a particular category of livestock that will excrete 73 kg of total nitrogen in a 12 month period; (« unité animale »)

"**aquifer**" means a water bearing geological formation that is capable of producing water to wells or springs in quantities that are

Définitions

1(1) Les définitions qui suivent s'appliquent au présent règlement.

« **animaux morts** » Bétail mort qui ne peut être mis en marché pour consommation humaine. ("mortalities")

« **aquifère** » Formation géologique contenant de l'eau et capable de fournir de l'eau à des puits ou à des sources en des quantités importantes au point de vue économique. ("aquifer")

« **bétail** » Animaux, y compris la volaille, qui ne sont pas gardés exclusivement à titre d'animaux de compagnie. La présente définition exclut les abeilles. ("livestock")

« **compostage** » Système conçu et géré afin que soit facilitée la décomposition aérobie de matières organiques par action biologique. ("composting")

« **cours d'eau de surface** » S'entend notamment de toute masse d'eau de surface et de tout endroit, créé naturellement ou artificiellement, qui contient de façon permanente ou intermittente de l'eau de surface; la présente définition exclut les mares-réservoirs situées sur les lieux d'une exploitation agricole. ("surface watercourse")

« **déjections du bétail solides** » Déjections du bétail qui sont composées d'au moins 20 % de matières solides et qui ne s'écoulent pas lorsqu'elles sont empilées. ("solid livestock manure")

« **doline** » Dépression en surface située dans une région karstique et de laquelle les eaux s'écoulent directement dans un aquifère du substratum rocheux sous-jacent ou dans la partie non saturée de l'unité géologique formant un aquifère du substratum rocheux. ("sinkhole")

« **eau de surface** » Masse d'eau mouvante ou stagnante, créée naturellement ou artificiellement; la présente définition vise

economically useful; (« aquifère »)

"**composting**" means a designed and managed system to facilitate the process of aerobic decomposition of organic matter by biological action; (« compostage »)

"**confined livestock area**" means an outdoor, non-grazing area where livestock are confined by fences or other structures, or topography, and includes a feedlot, paddock, corral, exercise yard and holding area; (« espace clos »)

"**earthen storage facility**" means a structure built primarily from soil, constructed by excavating or forming dikes, and used to retain livestock manure; (« installation de stockage en terre »)

"**feedlot**" means a fenced area where livestock are confined solely for the purpose of growing or finishing, and are sustained by means other than grazing; (« parc d'engraissement »)

"**field storage**" means solid livestock manure that is stored in the open air other than in a manure storage facility; (« stockage dans les champs »)

"**groundwater**" means water below the surface of the ground; (« eau souterraine »)

"**livestock**" means animals or poultry not kept exclusively as pets, excluding bees; (« bétail »)

"**manure storage facility**" means a structure, reservoir, earthen storage facility, molehill or tank for storing livestock manure, but does not include

(a) field storage,

(b) a vehicle or other mobile equipment used for transportation or disposal of livestock manure, or

(c) under-barn concrete storage pits used for short term containment of livestock manure; (« installation de stockage des déjections du bétail »)

"**modify**", in respect of a manure storage facility, does not include routine maintenance or repairs; (« modifier »)

"**molehill**" means a manure storage facility for

notamment les lacs, les rivières, les ruisseaux, les sources, les marais et les marécages ainsi que la glace qui se forme sur ces étendues d'eau, mais exclut les mares-réservoirs situées sur les lieux d'une exploitation agricole. ("surface water")

« **eau souterraine** » Eau qui se trouve sous la surface du sol. ("groundwater")

« **espace clos** » Espace à l'air libre, autre qu'un pâturage, où le bétail est confiné soit par des constructions, notamment des clôtures, soit par la topographie. La présente définition vise également les parcs d'engraissement, les enclos, les corrals, les aires d'exercice et les aires d'attente. ("confined livestock area")

« **exploitant** » Personne qui dirige une exploitation agricole. ("operator")

« **exploitation agricole** » Exploitation agricole, aquicole, horticole ou sylvicole poursuivie dans l'attente d'un gain ou d'une rétribution. La présente définition inclut :

a) le labourage du sol;

b) la production de récoltes agricoles, y compris le foin et les fourrages;

c) la production de récoltes horticoles, y compris les légumes, les fruits, les champignons, le gazon, les arbres, les arbustes et les récoltes de serre;

d) l'élevage de bétail;

e) la production d'oeufs, de lait et de miel;

f) l'élevage de gibier, d'animaux à fourrure, de gibier à plumes, d'abeilles et de poissons;

g) le maniement de machines et de matériel agricoles;

h) le traitement nécessaire pour la préparation d'un produit agricole en vue de sa distribution depuis la ferme;

i) l'épandage d'engrais, de fumier, d'amendements et de pesticides, y compris la pulvérisation au sol et la pulvérisation aérienne;

dairy manure in which manure is mechanically forced through a pipe and becomes mounded; (« monticule »)

"**mortalities**" means dead livestock that are not marketable for human consumption; (« animaux morts »)

"**operator**" means a person who carries on an agricultural operation; (« exploitant »)

"**person**" includes a corporation, cooperative, partnership and limited-partnership; (« personne »)

"**pollution**", in relation to surface water, groundwater, or soil, means the presence in the water or soil of substances or contaminants that are foreign to or in excess of the natural constituents of the water or soil, or that adversely affects the uses of the water or soil; (« pollution »)

"**poultry**" means any variety of fowl, including the breeding stock of that fowl, kept to produce

(a) meat or eggs, or

(b) feathers for commercial or other purposes; (« volaille »)

"**refrigerated**", in relation to mortalities, means kept at a constant temperature of not more than 4°C; (« réfrigération »)

"**sinkhole**" means a surface depression found in karst terraines that drains directly into an underlying bedrock aquifer or the unsaturated portion of the geological unit forming a bedrock aquifer; (« doline »)

"**solid livestock manure**" means livestock manure that is 20% or more solid matter and does not flow when piled; (« déjections du bétail solides »)

"**surface water**" means any body of flowing or standing water, whether naturally or artificially created, including but not limited to a lake, river, creek, spring, swamp, wetland, and marsh,

j) le stockage, l'utilisation ou l'élimination de déchets organiques à des fins agricoles. ("agricultural operation")

« **installation de stockage en terre** » Ouvrage réalisé principalement à l'aide de terre, érigé par excavation ou aménagement de levées et servant à retenir les déjections du bétail. ("earthen storage facility")

« **installation de stockage de déjections** » Ouvrage, réservoir, installation de stockage en terre, monticule ou cuve servant à stocker les déjections du bétail. La présente définition exclut :

a) le stockage dans les champs;

b) les véhicules et les autres pièces d'équipement mobile utilisés pour le transport ou l'élimination des déjections du bétail;

c) les fosses en béton situées sous les étables et servant au confinement temporaire des déjections du bétail. ("manure storage facility")

« **modifier** » Exclut l'entretien et les travaux de réparation normaux des installations de stockage de déjections. ("modify")

« **monticule** » Installation de stockage des déjections du bétail laitier dans laquelle les déjections sont déversées mécaniquement à l'aide d'un tuyau et forment un amas. ("molehill")

« **parc d'engraissement** » Enclos où le bétail est confiné uniquement en vue de sa croissance ou de son engraissement et se nourrit autrement qu'en pâturant. ("feedlot")

« **personne** » Sont assimilés aux personnes les corporations, les coopératives, les sociétés en nom collectif et les sociétés en commandite. ("person")

« **pollution** » Présence dans l'eau de surface, l'eau souterraine ou le sol de substances ou de polluants étrangers à ses éléments naturels ou en excédent de ceux-ci ou nuisant à son utilisation. ("pollution")

« **réfrigération** » Conservation des animaux morts à une température constante d'au plus 4°C. ("refrigerated")

including ice on any of them, but not including a dugout on the property of the agricultural operation; (« eau de surface »)

"**surface watercourse**" includes a body of surface water and an area, whether naturally or artificially created, that perennially or intermittently contains surface water, but does not include a dugout on the property of the agricultural operation. (« cours d'eau de surface »)

« **stockage dans les champs** » Stockage des déjections du bétail solides à l'air libre mais ailleurs que dans une installation de stockage de déjections. ("field storage")

« **unité animale** » Nombre d'animaux d'une catégorie particulière qui excrètent un total de 73 kg d'azote au cours d'une période de 12 mois. ("animal unit")

« **volaille** » Toute espèce de volaille, y compris les reproducteurs, élevée aux fins de la production, selon le cas :

a) de chair ou d'oeufs;

b) de plumes à des fins commerciales ou autres. ("poultry")

1(2) For the purpose of the definition "**animal unit**" in subsection 1(1), the categories of livestock shall be determined by the director taking into consideration any guidelines or standards published or approved by the Department of Agriculture of Manitoba.

1(2) Pour l'application de la définition de « **unité animale** », au paragraphe (1), le directeur établit les catégories de bétail en tenant compte des lignes directrices et des normes que publie ou approuve le ministère de l'Agriculture du Manitoba.

1(3) For the purpose of the definitions "**surface water**" and "**surface watercourse**" in subsection 1(1), when this regulation requires any thing to be located a certain distance from surface water or a surface watercourse, that distance is to be measured from the high water mark of the surface water or watercourse or from the nearest and highest bank of the surface water or watercourse, whichever is further from the surface water or watercourse.

1(3) Pour l'application des définitions de « **eau de surface** » et de « **cours d'eau de surface** », au paragraphe (1), la distance qui, en vertu du présent règlement, doit séparer des biens de l'eau de surface ou d'un cours d'eau de surface est mesurée à partir du niveau des hautes eaux ou du bord le plus rapproché et le plus exhaussé de l'eau de surface ou du cours d'eau de surface, selon ce qui est le plus éloigné de cette eau ou de ce cours d'eau.

1(4) In determining the number of animal units in an agricultural operation for the purposes of sections 13 and 14,

(a) an agricultural operation has less than 400 animal units if it has less than 400 animal units of each category of livestock in the operation, notwithstanding that the total number of animal units of all the categories of livestock in the operation is 400 or more; and

(b) an agricultural operation has 400 animal units or more only if it has 400 animal units or more of at least one category of livestock.

1(4) Pour l'application des articles 13 et 14 :

a) une exploitation agricole est réputée posséder moins de 400 unités animales si, pour chaque catégorie de bétail, elle possède moins de 400 unités animales, et ce, même si le nombre total d'unités animales, toute catégorie confondue, est d'au moins 400;

b) une exploitation agricole est réputée posséder au moins 400 unités animales si elle possède au moins 400 unités animales appartenant à au moins une des catégories de bétail.

PURPOSE

Purpose
2 The purpose of this regulation is to prescribe requirements for the use, management and storage of livestock manure and mortalities in agricultural operations so that livestock manure and mortalities are handled in an environmentally sound manner.

OBJET

Objet
2 Le présent règlement a pour objet de prévoir les conditions d'utilisation, de gestion et de stockage des déjections du bétail et des animaux morts dans des exploitations agricoles de façon que leur manutention se fasse dans le respect de l'environnement.

STORAGE AND COMPOSTING OF LIVESTOCK MANURE

Storage methods
3 No person shall store livestock manure in an agricultural operation except

(a) in a manure storage facility; or

(b) as field storage.

Size and operation of manure storage facility
4 An operator who stores livestock manure in a manure storage facility shall

(a) ensure that the manure storage facility, alone or in combination with other manure storage facilities located on the property of the agricultural operation, is of sufficient capacity to store all of the livestock manure produced or used in the agricultural operation until such time as the livestock manure can either be applied as fertilizer or otherwise removed from the manure storage facility;

(b) design and construct the manure storage facility, or ensure that it is designed and constructed, so as to prevent the escape of any livestock manure that may cause pollution of surface water, groundwater or soil; and

(c) maintain and operate the manure storage facility in a manner that does not cause pollution of surface water, groundwater or soil.

Location of manure storage facility
5(1) No person shall locate a manure storage facility within the boundaries of the 100 year flood plain elevation unless, in the opinion of the director, satisfactory flood protection of the facility exists.

STOCKAGE ET COMPOSTAGE DES DÉJECTIONS DU BÉTAIL

Méthodes de stockage
3 L'exploitant qui stocke des déjections du bétail dans une exploitation agricole le fait :

a) soit dans une installation de stockage de déjections;

b) soit par stockage dans les champs.

Dimensions et utilisation de l'installation de stockage de déjections
4 L'exploitant qui stocke des déjections du bétail dans une installation de stockage de déjections :

a) fait en sorte que l'installation puisse, soit seule, soit conjointement avec d'autres installations de stockage de déjections se trouvant sur les lieux de l'exploitation agricole, contenir l'ensemble des déjections du bétail produites ou utilisées dans l'exploitation agricole jusqu'à ce que celles-ci puissent en être retirées, notamment pour servir d'engrais;

b) conçoit et construit l'installation de façon à empêcher tout déversement de déjections du bétail pouvant polluer l'eau de surface, l'eau souterraine ou le sol;

c) entretient et utilise l'installation d'une manière qui ne pollue pas l'eau de surface, l'eau souterraine ou le sol.

Emplacement de l'installation de stockage de déjections
5(1) Nul ne peut situer une installation de stockage de déjections dans les limites du niveau de la crue centenaire, sauf si l'installation est, de l'avis du directeur, suffisamment protégée contre les inondations.

5(2) Subsection (1) does not apply to a manure storage facility in operation on the day this regulation comes into force unless the agricultural operation is modified or expanded after that day.

5(3) No person shall locate a manure storage facility other than in accordance with the siting requirements set out in section 1 of Schedule A.

5(4) Subsection (3) does not apply to a manure storage facility in operation on the day this regulation comes into force if the facility meets the requirements of section 4.

Permit required for manure storage facility

6(1) No person shall construct, modify or expand a manure storage facility except under the authority of a permit issued by the director under this section.

6(2) An application for a permit shall be made by an operator to the director on a form approved by the director and be accompanied by the information required on the application form and any additional information that the director requires.

6(3) After receiving an application, the director shall, in order to determine the appropriate siting and construction requirements for a proposed manure storage facility,

(a) examine the site of the proposed facility and evaluate the soil type and the proximity of the facility to aquifers; or

(b) direct the applicant to conduct an examination and evaluation as described in clause (a) in a manner that is acceptable to the director.

6(4) An applicant is entitled to be issued a permit if

(a) the proposed construction, modification or expansion of the manure storage facility conforms to the siting and construction requirements set out in Schedule A; and

(b) in the case of a manure storage facility located on land

(i) that consists of coarse sands or gravel, or

5(2) Le paragraphe (1) ne s'applique pas aux installations de stockage de déjections qui sont déjà exploitées à la date d'entrée en vigueur du présent règlement, sauf si l'exploitation agricole est modifiée ou fait l'objet d'agrandissements par la suite.

5(3) Nul ne peut situer une installation de stockage de déjections autrement qu'en conformité avec les exigences prévues à l'article 1 de l'annexe A.

5(4) Le paragraphe (3) ne s'applique pas aux installations de stockage de déjections qui sont déjà exploitées à la date d'entrée en vigueur du présent règlement et qui sont conformes aux exigences que prévoit l'article 4.

Permis

6(1) Nul ne peut construire, modifier ou agrandir une installation de stockage de déjections si ce n'est en conformité avec un permis délivré par le directeur sous le régime du présent article.

6(2) La demande de permis d'un exploitant revêt la forme qu'approuve le directeur et est accompagnée des renseignements demandés dans la formule et par le directeur.

6(3) Sur réception de la demande de permis, le directeur est tenu, afin d'établir les exigences en matière d'emplacement et de construction auxquelles doit satisfaire l'installation de stockage de déjections :

a) d'examiner l'emplacement projeté, d'évaluer le type de sol et de déterminer la proximité d'aquifères;

b) d'ordonner à l'auteur de la demande de procéder à l'examen, à l'évaluation et à la détermination prévus à l'alinéa a) d'une manière qu'il juge acceptable.

6(4) L'auteur de la demande a le droit de se faire délivrer un permis si :

a) d'une part, les travaux projetés satisfont, en matière d'emplacement et de construction, aux exigences prévues à l'annexe A;

b) d'autre part, dans le cas d'une installation de stockage de déjections située sur un terrain constitué de sable grossier ou de gravier ou dans lequel se trouve un aquifère de roches fracturées dont la partie supérieure sera séparée

(ii) in which a fractured rock aquifer exists and less than 5 m of overburden having an expected hydraulic conductivity of 1×10^{-7} cm per second or less will separate the bottom of the facility, as constructed, modified or expanded, from the top of the aquifer,

the director is satisfied that the construction, modification or expansion can be carried out in a manner that ensures that the environment is protected.

6(5) The director may include terms and conditions in a permit.

6(6) An operator to whom a permit is issued shall comply with any terms and conditions contained in the permit and shall construct, modify or expand the manure storage facility or ensure that it is constructed, modified or expanded in a manner that conforms to the siting and construction requirements set out in Schedule A.

6(7) No person shall set into operation a manure storage facility for which a permit is required under this section unless the director has been provided with a professional engineer's certificate satisfactory to the director certifying that the completed construction, modification or expansion of the manure storage facility conforms to the siting and construction requirements set out in Schedule A.

6(8) Unless approved in writing by the director, no person shall construct, modify or expand a manure storage facility between November 1 of one year and April 30 of the following year.

6(9) At least five days prior to the commencement of construction, modification or expansion of a manure storage facility, the operator or the contractor constructing, modifying or expanding the facility shall notify an environment officer of the commencement date of the construction, modification or expansion.

Field storage

7(1) No person shall store livestock manure as field storage other than solid livestock manure.

7(2) A person who stores solid livestock manure as field storage shall

du fond de l'installation par un terrain de couverture mesurant moins de cinq mètres d'épaisseur et ayant une conductivité hydraulique prévue de 1×10^{-7} centimètre par seconde ou moins, le directeur est convaincu que les travaux peuvent être effectués dans le respect de l'environnement.

6(5) Le directeur peut assortir le permis de conditions.

6(6) L'exploitant à qui un permis est délivré observe les conditions de celui-ci et construit, modifie ou agrandit, ou veille à ce que soit construite, modifiée ou agrandie, l'installation de stockage de déjections conformément aux exigences prévues à l'annexe A.

6(7) Nul ne peut utiliser une installation de stockage de déjections devant faire l'objet d'un permis en vertu du présent article à moins de fournir au directeur un certificat d'ingénieur satisfaisant dans lequel il est attesté que la construction, la modification ou l'agrandissement de l'installation est conforme aux exigences prévues à l'annexe A.

6(8) À moins d'avoir obtenu l'autorisation écrite du directeur, nul ne peut construire, modifier ou agrandir une installation de stockage des déjections du bétail entre le 1er novembre d'une année et le 30 avril de l'année suivante.

6(9) Les exploitants et les entrepreneurs qui ont l'intention de construire, de modifier ou d'agrandir une installation de stockage de déjections avisent, au moins cinq jours avant le début des travaux, un agent de l'environnement de la date du début de ceux-ci.

Stockage dans les champs

7(1) Les seules déjections du bétail qui peuvent être stockées dans les champs sont celles qui sont solides.

7(2) La personne qui stocke des déjections du bétail solides dans les champs le fait :

(a) locate the livestock manure at least 100 m from any surface watercourse, sinkhole, spring or well; and

(b) store the livestock manure in a manner that does not cause pollution of surface water, groundwater or soil.

7(3) An operator shall construct dikes or other works around a field storage area, or ensure that they are constructed, if this is necessary to prevent the escape of livestock manure that may cause pollution of surface water, groundwater or soil.

Composting

8 No person shall compost livestock manure or mortalities on the property of an agricultural operation unless

(a) the composting site is located at least 100 m from any surface watercourse, sinkhole, spring or well; and

(b) the livestock manure or mortalities are composted in a manner that does not cause pollution of surface water, groundwater or soil.

TRANSPORTATION AND APPLICATION OF LIVESTOCK MANURE

Transportation

9(1) In this section and section 10, "manure spill" means

(a) a series of intentional or negligent spillages, leakages, discharges or deposits of livestock manure on a highway or road allowance by the same person or from the same agricultural operation regardless of the amount of any individual spill, leak, discharge or deposit;

(b) a single event involving a total volume of not less than 50 L of liquid livestock manure or 0.25 m^3 of solid livestock manure spilled, leaked, discharged or deposited on a highway or road allowance; or

(c) a spillage, leakage, discharge or deposit of livestock manure where the location or quantity of livestock manure spilled, leaked, discharged or deposited is such that an adverse effect on the environment has occurred, or on a reasonable basis, in the opinion of an

a) à au moins 100 mètres des cours d'eau de surface et des dolines, des sources ou des puits;

b) de manière à ne pas polluer l'eau de surface, l'eau souterraine ou le sol.

7(3) L'exploitant aménage ou veille à ce que soit aménagés des levées ou d'autres ouvrages autour de l'aire de stockage dans les champs si cette mesure est nécessaire pour empêcher tout déversement de déjections du bétail pouvant polluer l'eau de surface, l'eau souterraine ou le sol.

Compostage

8 Il n'est permis de composter des déjections du bétail ou des animaux morts sur les lieux de l'exploitation agricole qu'aux conditions suivantes :

a) le lieu du compostage est situé à au moins 100 mètres des cours d'eau de surface et des dolines, des sources ou des puits;

b) le compostage se fait de manière à ne pas polluer l'eau de surface, l'eau souterraine ou le sol.

TRANSPORT ET ÉPANDAGE DES DÉJECTIONS DU BÉTAIL

Transport

9(1) Pour l'application du présent article et de l'article 10, « déversement de déjections du bétail » s'entend :

a) d'une série de déversements, de fuites, d'écoulements ou de dépôts de déjections du bétail, qui surviennent intentionnellement ou par négligence, sur des routes ou des emprises routières et qui sont attribuables à la même personne ou à la même exploitation agricole, peu importe les quantités individuelles en cause;

b) du déversement, de la fuite, de l'écoulement ou du dépôt, en une seule fois, d'un volume total d'au moins 50 litres de déjections du bétail liquides ou 0,25 m^3 de déjections du bétail solides;

c) d'un déversement, d'une fuite, d'un écoulement ou d'un dépôt de déjections du bétail qui, en raison de l'endroit où il survient ou de la quantité des déjections en cause, est tel qu'un

environment officer, is likely to occur.

9(2) For the purposes of the definition "manure spill" in subsection (1), "highway" means a highway as defined in *The Highway Traffic Act* and "road allowance" means a road allowance as defined in *The Highways and Transportation Department Act*.

9(3) A person who transports livestock manure in a vehicle shall ensure that a manure spill from the vehicle does not occur.

Reportable spills

10 An operator, or a person who transports livestock manure in a vehicle, shall immediately report to an environment officer the occurrence of a manure spill.

No discharge into water

11(1) No person shall handle, use or dispose of livestock manure, or store livestock manure in an agricultural operation, in such a manner that it is discharged or otherwise released into surface water or groundwater.

11(2) An operator shall ensure that livestock manure that is handled, used, disposed of or stored in an agricultural operation is not discharged or otherwise released into surface water or groundwater.

Allowable application to land

12(1) No person shall apply livestock manure to land in an agricultural operation

(a) other than as a fertilizer; or

(b) at a rate of application such that the concentration of nitrate nitrogen in the soil exceeds

(i) for annual crops in medium to heavy (sandy loam to clay) textured soils, 157.1 kg/ha (140 lbs per acre) within the top 0.6 m (two feet) of soil at any location on the land,

(ii) for annual crops in lighter (loamy sand to sand) textured soils, 101 kg/ha (90 lbs per acre) within the top 0.6 m (two feet) of soil at any location on the land,

effet néfaste pour l'environnement s'est produit ou, de l'avis d'un agent de l'environnement, risque vraisemblablement de se produire.

9(2) Pour l'application de la définition de « déversement de déjections du bétail », au paragraphe (1), « route » s'entend au sens du *Code de la route* et « emprise » s'entend au sens de la *Loi sur le ministère de la Voirie et du Transport*.

9(3) La personne qui transporte à bord d'un véhicule des déjections du bétail fait en sorte que son véhicule ne déverse aucune de ces déjections.

Déversement – déclaration

10 Les exploitants ou les personnes qui transportent des déjections du bétail à bord d'un véhicule avisent immédiatement un agent de l'environnement de tout déversement de ces déjections.

Rejet dans l'eau

11(1) Nul ne peut manutentionner, utiliser, éliminer ou stocker des déjections du bétail dans une exploitation agricole de sorte que ces déjections soient rejetées d'une façon quelconque dans de l'eau de surface ou de l'eau souterraine.

11(2) L'exploitant fait en sorte que les déjections du bétail qui sont manutentionnées, utilisées, éliminées ou stockées dans l'exploitation agricole ne soient d'aucune façon rejetées dans de l'eau de surface ou de l'eau souterraine.

Épandage autorisé

12(1) Il n'est permis d'épandre des déjections du bétail sur une terre située dans une exploitation agricole :

a) qu'à titre d'engrais;

b) que dans la mesure où la concentration d'azote des nitrates dans le sol ne dépasse pas :

(i) dans le cas des cultures annuelles dans un sol dont la texture est de moyenne à forte (limon sableux à argile), 157,1 kg/ha (140 lb à l'acre) jusqu'à une profondeur de 0,6 m (deux pieds) dans le sol sur l'étendue de l'exploitation,

(ii) dans le cas des cultures annuelles dans un sol dont la texture est faible (limon sableux à sable), 101 kg/ha (90 lb à l'acre) jusqu'à une profondeur de 0,6 m (deux pieds) dans le sol sur l'étendue de l'exploitation,

(iii) for alfalfa crops, 308.5 kg/ha (275 lbs per acre) within the top 0.6 m (two feet) of soil at any location on the land,

(iv) for alfalfa-grass mixtures or grass forage crops, 224.4 kg/ha (200 lbs per acre) within the top 0.6 m (two feet) of soil at any location on the land, and

(v) for any other combination of crop or forage crop and soil condition, the amount necessary to meet the annual nitrogen requirements for the particular crop or forage crop in that soil.

(iii) dans le cas des cultures de luzerne, 308,5 kg/ha (275 lb à l'acre) jusqu'à une profondeur de 0,6 m (deux pieds) dans le sol sur l'étendue de l'exploitation,

(iv) dans le cas des cultures mélangées de légumineuses et de graminées et de cultures fourragères de graminées, 224,4 kg/ha (200 lb à l'acre) jusqu'à une profondeur de 0,6 m (deux pieds) dans le sol sur l'étendue de l'exploitation,

(v) dans le cas des autres combinaisons de cultures ou de cultures fourragères et de conditions du sol, la quantité nécessaire pour satisfaire aux exigences annuelles en matière d'azote relativement aux cultures ou cultures fourragères particulières faites dans ces sols.

12(2) No person shall apply livestock manure to land if, due to meteorological, topographical or soil conditions, or the rate of application, livestock manure

(a) causes pollution of surface water, groundwater or soil; or

(b) escapes from the boundary of the agricultural operation.

12(2) Nul ne peut épandre des déjections du bétail sur un sol si, en raison des conditions du sol, des conditions météorologiques ou topographiques ou du taux d'épandage, ces déjections :

a) polluent l'eau de surface, l'eau souterraine ou le sol;

b) s'échappent des limites de l'exploitation agricole en question.

12(3) An operator shall ensure that livestock manure is not applied to land in an agricultural operation except in accordance with subsections (1) and (2).

12(3) L'exploitant veille à ce que l'épandage des déjections du bétail sur le sol d'une exploitation agricole ne soit fait que conformément aux paragraphes (1) et (2).

Manure management plans

13(1) Subject to subsections (2) and (3) and commencing January 1, 1999, no person shall apply livestock manure to land except in accordance with a manure management plan registered with the director in accordance with subsection (4).

Plan de gestion des déjections du bétail

13(1) Sous réserve des paragraphes (2) et (3), à partir du 1er janvier 1999, il est interdit d'épandre des déjections du bétail sur un sol, si ce n'est en conformité avec un plan de gestion des déjections du bétail enregistré auprès du directeur conformément au paragraphe (4).

13(2) Subsection (1) does not apply to the operator of or a person employed in an existing agricultural operation that has less than 400 animal units on the day this regulation comes into force unless

(a) the operation is expanded after the coming into force of this regulation, and the expansion results in the number of animal units in the expanded operation being 400 or more; or

13(2) Le paragraphe (1) ne s'applique pas à l'exploitant ni aux employés d'une exploitation agricole qui compte moins de 400 unités animales à la date d'entrée en vigueur du présent règlement, sauf dans les cas suivants :

a) après l'entrée en vigueur du présent règlement, l'exploitation prend de l'expansion de sorte que le total des unités animales de l'exploitation passe à au moins 400;

(b) in the opinion of the director, the application of livestock manure to land in the agricultural operation would likely

(i) cause pollution of surface water, groundwater or soil, or

(ii) result in the livestock manure escaping from the boundary of the agricultural operation,

and the director notifies the operator, in writing, that subsection (1) applies to the agricultural operation for the period specified in the notice.

b) le directeur estime que l'épandage des déjections du bétail sur le sol de l'exploitation agricole risquerait de polluer l'eau de surface, l'eau souterraine ou le sol ou d'entraîner le déversement des déjections du bétail hors des limites de l'exploitation agricole et avise l'exploitant par écrit que le paragraphe (1) s'applique à l'exploitation agricole pour la période précisée dans l'avis.

13(3) Subsection (1) does not, until November 10, 1999, apply to the operator of or a person employed in an agricultural operation that has 400 animal units or more on the day this regulation comes into force unless, in the opinion of the director, the application of livestock manure to land in the agricultural operation would likely

(a) cause pollution of surface water, groundwater or soil; or

(b) result in the livestock manure escaping from the boundary of the agricultural operation;

and the director notifies the operator, in writing, that subsection (1) applies to the agricultural operation for the period specified in the notice.

13(3) Jusqu'au 10 novembre 1999, le paragraphe (1) ne s'applique pas à l'exploitant ni aux employés d'une exploitation agricole de 400 unités animales et plus à la date d'entrée en vigueur du présent règlement, sauf si le directeur estime que l'épandage des déjections du bétail sur le sol de l'exploitation agricole risquerait de polluer l'eau de surface, l'eau souterraine ou le sol ou d'entraîner le déversement des déjections du bétail hors des limites de l'exploitation agricole et avise l'exploitant par écrit que le paragraphe (1) s'applique à l'exploitation agricole pour la période précisée dans l'avis.

13(4) Except while he or she is exempted under subsection (2) or (3) from the operation of subsection (1), an operator shall, at least 60 days prior to the commencement of livestock manure application to land in any calendar year, submit to the director for registration a manure management plan for the year in a form approved by the director and containing or accompanied by the information required by the director.

13(4) Sauf s'il est exempté, en vertu du paragraphe (2) ou (3), de l'application du paragraphe (1), l'exploitant présente au directeur, au moins 60 jours avant le début de l'épandage des déjections du bétail au cours d'une année civile, un plan de gestion des déjections du bétail pour l'année, en la forme qu'approuve le directeur, lequel plan est accompagné des renseignements qu'exige celui-ci.

13(5) The director may register a manure management plan submitted under subsection (4), or may refuse to register the plan where

(a) the plan is not in the form approved by the director; or

(b) in the director's opinion, the operator would likely be in violation of this regulation if the plan was implemented as submitted.

13(5) Le directeur peut enregistrer un plan de gestion des déjections du bétail présenté sous le régime du paragraphe (4) ou en refuser l'enregistrement si :

a) le plan n'est pas en la forme qu'il a approuvée;

b) à son avis, l'exploitant risquerait de contrevenir au présent règlement si le plan était mis en oeuvre tel qu'il a été présenté.

13(6) A manure management plan registered under this section may be amended by the director at any time upon receipt of a written application from an operator containing or accompanied by the information required by the director.

Prohibitions on winter spreading

14(1) Except as provided in subsections (2) to (5), no person shall apply livestock manure to land between November 10 of one year and April 15 of the following year.

14(2) Subject to subsections (6) to (9), subsection (1) does not apply to the operator of, or a person employed in, an existing agricultural operation that has less than 400 animal units on the day this regulation comes into force.

14(3) Subject to subsections (6) to (9), subsection (1) does not, until November 10, 2003, apply to the operator of, or a person employed in, an existing agricultural operation that has 400 animal units or more on the day this regulation comes into force.

14(4) Where, due to an emergency situation or to other extenuating circumstances, the director has given an operator prior authorization to apply livestock manure to land during all or part of the period between November 10 and the following April 15, subsection (1) does not apply to the operator or employees of the agricultural operation during that period.

14(5) Where the director considers it appropriate considering local soil and weather conditions, he or she may by order vary the dates provided for in subsection (1) in relation to such part of the province as may be mentioned in the order.

14(6) Notwithstanding subsections (2) and (3) and subject to subsection (7), no person shall apply livestock manure to land between November 10 of one year and April 15 of the following year except in accordance with the minimum setback distance requirements set out in Schedule B.

14(7) Notwithstanding subsections (2), (3) and (6), no person shall apply livestock manure to land between November 10 of one year and April 15 of the following year if the mean slope of the land is 12% or more.

14(8) Notwithstanding subsections (2) and (3), the director may by order prohibit an operator from applying livestock manure to land in the agricultural

13(6) Sur réception d'une demande écrite de l'exploitant accompagnée des renseignements qu'il exige, le directeur peut modifier un plan de gestion des déjections du bétail enregistré en vertu du présent article.

Interdiction – épandage d'hiver

14(1) Sous réserve des paragraphes (2) à (5), nul ne peut épandre des déjections du bétail sur le sol entre le 10 novembre d'une année et le 15 avril de l'année suivante.

14(2) Sous réserve des paragraphes (6) à (9), le paragraphe (1) ne s'applique pas à l'exploitant ni aux employés d'une exploitation agricole qui compte moins de 400 unités animales à la date d'entrée en vigueur du présent règlement.

14(3) Sous réserve des paragraphes (6) à (9) et jusqu'au 10 novembre 2003, le paragraphe (1) ne s'applique pas à l'exploitant ni aux employés d'une exploitation agricole qui compte au moins 400 unités animales à la date d'entrée en vigueur du présent règlement.

14(4) Le paragraphe (1) ne s'applique pas à l'exploitant ni aux employés d'une exploitation agricole qui, en raison d'une situation d'urgence ou de circonstances atténuantes, ont obtenu l'autorisation du directeur d'épandre des déjections du bétail sur le sol entre le 10 novembre d'une année et le 15 avril de l'année suivante.

14(5) Le directeur peut, s'il l'estime indiqué compte tenu du sol et des conditions météorologiques de la région, modifier par ordre les dates prévues au paragraphe (1) pour la partie de la province indiquée dans l'ordre.

14(6) Malgré les paragraphes (2) et (3) et sous réserve du paragraphe (7), nul ne peut épandre des déjections du bétail sur le sol entre le 10 novembre d'une année et le 15 avril de l'année suivante, si ce n'est en conformité avec les exigences relatives à la distance minimale indiquées à l'annexe B.

14(7) Malgré les paragraphes (2), (3) et (6), nul ne peut épandre des déjections du bétail sur le sol entre le 10 novembre d'une année et le 15 avril de l'année suivante si la pente moyenne du sol est de 12 % et plus.

14(8) Malgré les paragraphes (2) et (3), le directeur peut par ordre interdire à un exploitant d'épandre des déjections du bétail sur le sol de son

operation during all or part of the period between November 10 of one year and April 15 of the following year where, in the opinion of the director, the application would likely

(a) cause pollution of surface water, groundwater or soil; or

(b) result in the livestock manure escaping from the boundary of the agricultural operation.

14(9) Where the director has made an order under subsection (8) in relation to an agricultural operation, no person shall apply livestock manure to land in the agricultural operation except in accordance with the order.

exploitation agricole pendant la période comprise entre le 10 novembre d'une année et le 15 avril de l'année suivante si, selon lui, l'épandage risquerait :

a) de polluer l'eau de surface, l'eau souterraine ou le sol;

b) d'entraîner le déversement des déjections du bétail hors des limites de l'exploitation agricole.

14(9) Dans le cas où le directeur a donné l'ordre que vise le paragraphe (8) relativement à une exploitation agricole, nul ne peut épandre des déjections du bétail sur le sol de cette exploitation agricole si ce n'est en conformité avec l'ordre.

DISPOSAL OF MORTALITIES

Disposal of mortalities

15(1) No person shall keep mortalities in or at an agricultural operation unless the mortalities are kept

(a) in a secure storage room, container or location; and

(b) continually frozen or refrigerated, if not disposed of within 48 hours after death.

15(2) No person shall dispose of mortalities except by

(a) burial or incineration, in accordance with subsection (3);

(b) composting in accordance with subsection (4); or

(c) delivery to a rendering plant.

15(3) No person shall dispose of mortalities by incineration or burial on the property of an agricultural operation unless

(a) the disposal does not cause pollution of surface water, groundwater or soil;

(b) where disposal is by burial,

(i) mortalities in a burial pit are covered with a minimum of one metre of soil,

ÉLIMINATION DES ANIMAUX MORTS

Élimination des animaux morts

15(1) Nul ne peut garder des animaux morts dans une exploitation agricole sauf s'ils sont gardés :

a) dans une salle de stockage, un conteneur ou un lieu sûr;

b) congelés ou réfrigérés continuellement, s'ils ne sont pas éliminés dans les 48 heures suivant leur mort.

15(2) Nul ne peut éliminer des animaux morts autrement que par :

a) enfouissement ou incinération, conformément au paragraphe (3);

b) compostage, conformément au paragraphe (4);

c) remise de ceux-ci à une usine d'équarrissage.

15(3) Nul ne peut éliminer les animaux morts par incinération ou enfouissement sur les lieux de l'exploitation agricole, sauf en conformité avec les conditions suivantes :

a) l'élimination ne pollue pas l'eau de surface, l'eau souterraine ou le sol;

b) en cas d'enfouissement :

(i) les animaux morts placés dans une fosse sont couverts d'au moins un mètre de terre,

(ii) the disposal site is located at least 100 m from any surface watercourse, sinkhole, spring or well, and

(iii) the disposal site is constructed so as to prevent the escape of any decomposition products of the mortalities that cause or may cause pollution of surface water, groundwater or soil; and

(c) where disposal is by incineration, the installation and operation of the incinerator is in compliance with the *Incinerators Regulation*.

15(4) No person shall compost mortalities on the property of an agricultural operation unless

(a) the composting site is located at least 100 m from any surface watercourse, sinkhole, spring or well; and

(b) the composting does not cause pollution of surface water, groundwater or soil.

15(5) An operator shall ensure that mortalities are not kept in or at an agricultural operation or disposed of, except in accordance with subsections (1) to (4).

(ii) le lieu d'élimination est situé à au moins 100 mètres des cours d'eau de surface, des dolines, des sources ou des puits,

(iii) le lieu d'élimination est aménagé de façon à empêcher tout déversement de produits provenant de la décomposition des animaux morts polluant ou pouvant polluer l'eau de surface, l'eau souterraine ou le sol;

c) en cas d'incinération, l'installation et l'exploitation de l'incinérateur sont conformes au *Règlement sur ies incinérateurs*.

15(4) Nul ne peut composter des animaux morts sur les lieux d'une exploitation agricole, sauf en conformité avec les conditions suivantes :

a) le lieu du compostage est situé à au moins 100 mètres des cours d'eau de surface, des dolines, des sources et des puits;

b) le compostage ne pollue pas l'eau de surface, l'eau souterraine ou le sol.

15(5) L'exploitant veille à ce que les animaux morts ne puissent être gardés dans une exploitation agricole ou éliminés qu'en conformité avec les dispositions des paragraphes (1) à (4).

CONFINED LIVESTOCK AREAS

Confined areas

16(1) An operator shall ensure that livestock in a confined livestock area of an agricultural operation do not have access to surface water.

16(2) No person shall operate a confined livestock area of an agricultural operation in a manner that causes pollution of surface water, groundwater or soil.

16(3) When there are livestock comprising more than 10 animal units in a confined livestock area of an agricultural operation, the operator shall locate the area at least 100 m from any surface watercourse.

ESPACES CLOS

Espaces clos

16(1) L'exploitant veille à ce que le bétail qui se trouve dans un espace clos situé dans une exploitation agricole n'ait pas accès à l'eau de surface.

16(2) Nul ne peut utiliser les espaces clos de l'exploitation agricole de manière à polluer l'eau de surface, l'eau souterraine ou le sol.

16(3) L'exploitant situe tout espace clos de l'exploitation agricole dans lequel se trouvent plus de 10 unités de bétail à au moins 100 mètres des cours d'eau de surface.

Variation of requirements

17 The minister may, upon written application or on his or her own initiative vary any of the requirements of this regulation in respect of an agricultural operation, where in the opinion of the minister, an innovative and environmentally sound practice or procedure relating to the use, management or storage of livestock manure or mortalities is not sanctioned or is prohibited by this regulation.

Review

18 Not later than five years after the day on which this regulation comes into force, the minister shall

(a) review the effectiveness of the operation of this regulation including consulting with such persons affected by it as the minister considers appropriate; and

(b) recommend to the Lieutenant Governor in Council that the regulation be amended, continued or repealed.

Repeal

19 The *Livestock Waste Regulation*, Manitoba Regulation 81/94, is repealed.

Modification des exigences

17 Le ministre peut, sur réception d'une demande écrite en ce sens ou de sa propre initiative, modifier les exigences du présent règlement à l'égard d'une exploitation agricole lorsqu'il estime qu'une pratique ou une méthode innovatrice et sans danger pour l'environnement en ce qui concerne l'utilisation, la gestion ou le stockage des déjections du bétail ou d'animaux morts n'est pas permise ou est interdite par le présent règlement.

Révision

18 Au plus tard cinq ans après la date d'entrée en vigueur du présent règlement, le ministre :

a) passe en revue l'efficacité du présent règlement et consulte à ce sujet les personnes dont l'opinion lui paraît utile;

b) recommande au lieutenant-gouverneur en conseil la modification, le maintien ou l'abrogation du présent règlement.

Abrogation

19 Est abrogé le *Règlement sur les déjections du bétail*, *R.M.* 81/94.

SCHEDULE A
(Sections 5 and 6)

SITING AND CONSTRUCTION REQUIREMENTS FOR MANURE STORAGE FACILITIES

Siting requirements

1 The construction, modification or expansion of a manure storage facility shall meet the following minimum setback requirements:

(a) 100 m from any surface watercourse;

(b) 100 m from any sinkhole, spring or well;

(c) 100 m from the boundaries of the agricultural operation.

General construction requirements

2 The construction, modification or expansion of an earthen storage facility shall meet the following construction requirements:

(a) the storage volume of the completed earthen storage facility shall meet the requirements of clause 4(a) of this regulation;

(b) topsoil shall be stripped from the area where any dike is to be constructed before excavation and compaction;

(c) all excavated material shall be placed in 0.15 m lifts and then compacted;

(d) where a synthetic liner will not be installed, the sides and bottom of the earthen storage facility shall be disced to a minimum depth of 20 cm and compacted with a fully ballasted sheepsfoot packer to within 95% of maximum Standard Proctor dry density (most recent edition of the American Society for the Testing of Materials D698) at a moisture content between 0.9 and 1.2 optimum;

(e) excavation and compaction shall be completed during temperature conditions that are above freezing;

ANNEXE A
(articles 5 et 6)

EXIGENCES EN MATIÈRE D'EMPLACEMENT ET DE CONSTRUCTION DES INSTALLATIONS DE STOCKAGE DE DÉJECTIONS

Exigences en matière d'emplacement

1 Les installations de stockage de déjections doivent se trouver à au moins :

a) 100 mètres des cours d'eau de surface;

b) 100 mètres des dolines, des sources et des puits;

c) 100 mètres des limites de l'exploitation agricole.

Exigences générales en matière de construction

2 La construction, la modification ou l'agrandissement de toute installation de stockage en terre doit satisfaire aux exigences suivantes :

a) une fois les travaux terminés, l'installation de stockage doit avoir une capacité de stockage conforme aux exigences de l'alinéa 4a) du présent règlement;

b) la terre de surface doit être enlevée à l'endroit où des levées doivent être aménagées avant les travaux d'excavation et de compactage;

c) les matériaux excavés doivent être étalés en couches de 0,15 mètres puis être compactés;

d) dans le cas où un revêtement synthétique ne sera pas installé, les côtés et le fond de l'installation sont endigués jusqu'à une profondeur minimale de 20 centimètres puis sont compactés à l'aide d'un rouleau à pieds de mouton entièrement ballasté de façon qu'ils aient plus de 95 % de leur masse volumique sèche maximale établie à l'aide de l'essai Proctor normal (édition la plus récente de l'ASTM D698) lorsque la teneur en humidité se situe entre 0,9 et 1,2 du niveau optimal;

e) les travaux d'excavation et de compactage sont faits pendant que la température se situe au-dessus du point de congélation;

(f) where the proposed site for the earthen storage facility

(i) is within the unsaturated portion of an aquifer, or

(ii) is a site where a minimum of 2.0 m of overburden having an expected hydraulic conductivity of 1×10^{-7} cm per second or less will not occur between the bottom of the facility, as constructed, modified or expanded, and the top of the uppermost underlying aquifer,

a synthetic liner acceptable to the director shall be installed;

(g) the bottom of the earthen storage facility shall be at least 1.0 m above the elevation of the water table;

(h) dike protection, in the form of rip-rap, concrete, or other material approved in writing by an environment officer, shall be constructed at the following locations:

(i) at the access ramp where agitation equipment or a pump is rolled into the earthen storage facility in connection with agitation or pumping operations,

(ii) at the point of discharge of the inlet pipe, where livestock manure is pumped into the earthen storage facility,

(iii) in the case of earthen storage facilities with two or more cells, at the overflow channel;

(i) all dikes of the earthen storage facility shall be seeded to grass within one year of construction.

Special requirements for coarse sands, gravel and fractured rock

3(1) If

(a) an earthen storage facility is proposed to be constructed, modified or expanded on land

(i) consisting of coarse sands or gravel, or

(ii) in which a fractured rock aquifer exists and less than 5.0 m of overburden having an expected hydraulic conductivity of 1×10^{-7} cm per second or less will separate the bottom of the facility, as

f) dans le cas où l'emplacement prévu pour l'installation est situé dans la partie non saturée d'un aquifère ou lorsque le fond de l'installation ne sera pas séparé de la partie supérieure de l'aquifère sous-jacent par un terrain de couverture mesurant au moins deux mètres d'épaisseur et ayant une conductivité hydraulique prévue de 1×10^{-7} centimètre par seconde ou moins, une doublure en plastique jugée acceptable par le directeur est installée;

g) le fond de l'installation se trouve à au moins un mètre au-dessus du niveau phréatique.

h) une digue de sécurité faite d'un perré, de béton ou d'un autre matériau qu'approuve par écrit un agent de l'environnement, est construite aux endroits suivants :

(i) à la rampe d'accès à l'endroit où est introduit dans l'installation de stockage en terre de l'équipement d'agitation ou une pompe dans le cadre des activités d'agitation ou de pompage,

(ii) au point de rejet de la canalisation d'arrivée, à l'endroit où les déjections du bétail sont pompées dans l'installation de stockage en terre,

(iii) dans le cas d'installations de stockage en terre comportant au moins deux bassins, au canal de trop-plein;

i) les digues de l'installation de stockage en terre sont mises en herbe dans l'année qui suit leur construction.

Exigences particulières - sable grossier et gravier

3(1) Dans le cas où la construction, la modification ou l'agrandissement d'une installation de stockage en terre doit avoir lieu sur un terrain constitué de sable grossier ou de gravier ou dans lequel se trouve un aquifère de roches fracturées dont la partie supérieure sera séparée du fond de l'installation par un terrain de couverture mesurant moins de cinq mètres d'épaisseur et ayant une conductivité hydraulique prévue de 1×10^{-7} centimètre par seconde ou moins, le directeur détermine celle des mesures prévues au paragraphe (2) qui doit être prise s'il est convaincu

constructed, modified or expanded, from the top of the aquifer; and

(b) the director is satisfied that the construction, modification or expansion can be carried out in a manner that ensures that the environment is protected;

the method of construction is to be determined by the director under subsection (2).

3(2) In the circumstances described in subsection (1), the director shall determine one of the following methods of construction:

(a) the installation of a synthetic liner;

(b) the installation of a synthetic liner accompanied by a groundwater monitoring plan or system acceptable to the director;

(c) an alternative method of construction acceptable to the director.

que les travaux peuvent être effectués dans le respect de l'environnement.

3(2) Dans le cas prévu au paragraphe (1), le directeur choisit l'une des mesures suivantes :

a) installation d'une doublure en plastique;

b) installation d'une doublure en plastique accompagnée d'un plan ou d'un système d'analyse de l'eau souterraine qu'il juge acceptable;

c) toute autre mesure qu'il juge acceptable.

SCHEDULE B
(Section 14)

SETBACK REQUIREMENTS FOR WINTER SPREADING OF LIVESTOCK MANURE

1 Where livestock manure spreading on land between November 10 of one year and April 15 of the following year is allowed under this regulation, the following minimum setback distance requirements apply :

(a) 10 m from any property boundary;

(b) for land having a mean slope of less than 4%, 150 m from any surface watercourse, sinkhole, spring or well;

(c) for land having a mean slope of 4% or more but less than 6%, 300 m from any surface watercourse, sinkhole, spring or well;

(d) for land having a mean slope of 6% or more but less than 12%, 450 m from any surface watercourse, sinkhole, spring or well.

ANNEXE B
(article 14)

EXIGENCES RELATIVES AUX DISTANCES POUR L'ÉPANDAGE DES DÉJECTIONS DU BÉTAIL EN HIVER

1 L'épandage des déjections du bétail sur le sol permis par le présent règlement entre le 10 novembre d'une année et le 15 avril de l'année suivante, doit se faire à une distance de :

a) 10 mètres des limites des propriétés;

b) 150 mètres des cours d'eau de surface, des dolines, des sources et des puits, lorsque le sol a une pente moyenne de moins de 4 %;

c) 300 mètres des cours d'eau de surface, des dolines, des sources et des puits, lorsque le sol a une pente moyenne d'au moins 4 % mais de moins de 6 %;

d) 450 mètres des cours d'eau de surface, des dolines, des sources et des puits, lorsque le sol a une pente moyenne d'au moins 6 % mais de moins de 12 %.

APPENDIX C

IMPERIAL UNITS

TABLE 1: COMPONENTS OF A MANURE HANDLING SYSTEM FOR LIVESTOCK PRODUCTION

Operation	Solids	Semi-Solid/Liquids
Collection	Gutter Cleaners Front-End Loaders Belt	Slotted Floors (complete with gutters) Scrapers Cable Hydraulic Tractor
Transfer	Manure Wagons Open Tank Spreaders Dump Trucks Earth Moving Equipment	Pumps Submerged, open impeller Piston Pneumatic Augers Vacuum Tank Wagon Pipeline Gravity Continuous-Flow Gutters Large-Diameter Pipes
Storage	Pile Bunk Silo	Glass Lined Steel Concrete Earthen
Treatment	Aerobic compost dry incinerate Anaerobic	Aerobic Pre-storage Partial Total Anaerobic Solid/Liquid Separation
Utilize/Disposal	Land Application Energy Production (e.g. biogas)	Land Application Irrigation Energy Production

TABLE 2: REQUIRED MANURE STORAGE SETBACKS FROM SURFACE WATERCOURSES, SINKHOLES, SPRINGS AND WELLS[1]

Storage Type	Distance (ft) To	
	Watercourse	Source of Domestic Water
All manure storage structures	328	328
Field Storage	328	328
Composting	328	328

[1] Refer to Appendix B, Livestock Manure and Mortalities Management Regulation.

TABLE 3: MANURE STORAGE VOLUME REQUIREMENTS (including spilled and wash water)

Poultry Type	Number of Flocks per Year	Housing System	Annual Production per Bird Space	
			lb/year	Ft^3 /year
Chicken:				
Broilers	6	Floor[2]	22.9	1.23
Roasters	5	Floor[2]	22.9	1.16
Layers	1	Cage[1]	145.2	2.33
		Floor[3]	43.6	1.68
Pullets	2	Cage[1]	44.0	0.71
		Floor[2]	15.0	0.75
Broiler Breeder Pullets	2	Floor[2]	19.4	0.99
Broiler Breeder Hens	1	Floor[3]	57.2	2.30
Turkey:				
Broilers	3	Floor[2]	55.0	2.83
Heavy Toms	2	Floor[2]	110.0	5.58
Heavy Hens	2	Floor[2]	66.0	3.32

[1] Manure removed from barn at 90% moisture content with a density of 59 lb/ft^3.

[2] Two inches of wood shavings or 4" of straw placed on floor. Manure and litter removed from barn at 25% moisture content, with a density of 20 lb/ft^3.

[3] One-third litter floor, two-thirds slatted floor. Manure and litter removed from barn at 40% moisture content, with a density of 25 lb/ft^3.

TABLE 4: TYPICAL POULTRY MANURE NUTRIENT CONTENT

Parameter	Total Nitrogen	Ammonia	Organic Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)	Dry Matter
Solid manure (lb/ton)	34.4	2.3	32.1	30.4	28.1	60
Liquid manure (lb/1000 gal)	53.0	48.0	5.0	11.7	17.2	4

TABLE 5: NUTRIENT LOSS, ODOUR SUPPRESSION AND RECOMMENDED SETBACKS FOR SPREADING LIVESTOCK MANURE WITH DIFFERENT METHODS

Application Method	N loss (%)	Odour Suppression	Recommended Setbacks (ft)		
			Property Line	Residence	Designated Residential Area
Injection	0-2	Maximum	10	49	246
Surface-applied, incorporated within 2 days	15-25	Good	33	246	1,311
Surface-applied, no incorporation	40-60	Moderate to none	33	492	2,620
Irrigation	60-80	None	49	984	5,280

TABLE 6: RECOMMENDED DISTANCES[1] FROM WATERCOURSES, SINKHOLES, SPRINGS, WELLS AND RESIDENTIAL PROPERTY LINES FOR MANURE SPREADING (feet)[1]

Slope	Application Method		
	Surface-Applied and Irrigation[2]		
	No incorporation	Incorporation within 48 hours	Injection
less than 4%	98	66	16
4 - 6%	197	131	33
6 – 12%	295	197	49

[1] Distances based on soil not supporting perennial forage crops or with minimal trash cover.

[2] Where a perennial forage crop or good trash cover is present, distances may be reduced by 1/2.

TABLE 7: REQUIRED[1] DISTANCE FROM WATERCOURSES, SINKHOLES, SPRINGS, WELLS AND RESIDENTIAL PROPERTY LINES FOR MANURE SPREADING BETWEEN NOVEMBER 10 AND APRIL 15 (feet)

Slope	Application Method		
	Surface Applied and Irrigation		
	No incorporation	Incorporation within 48 hours	Injection
less than 4%	495	N/A	N/A
4 - 6%	984	N/A	N/A
6 – 12%	1,475	N/A	N/A
Greater than 12%	Prohibited	Prohibited	Prohibited

[1] Refer to the Livestock Manure and Mortalities Management Regulation – Appendix B.

TABLE 8. LOSS FOR MANURE NITROGEN DURING AND AFTER APPLICATION

Application Method	Nitrogen Loss (%)
Injection (immediate incorporation)	0-2
Broadcast, incorporation within 2 days	15-25
Broadcast, incorporation after 2 days	25-35
Broadcast, incorporation after 3 days	40-60
Broadcast, no incorporation and on established forage	35
Irrigation, incorporation within 3 days	25-35
Irrigation, no incorporation after 3 days	60-80

TABLE 9: GENERAL RECOMMENDATIONS FOR NITROGEN APPLICATION RATES

Crop	Soil Type	Recommended (lb/acres)[1]
Forages, established stands		
Alfalfa	all types	225
Grasses	all types	150
Grass-Alfalfa Mixtures	all types	175
Annual Crops	Medium to heavy soils	80
	Light soils	60

TABLE 10: MANURE APPLICATION RATE CALCULATION WORKSHEET

Step 1. Soil Test Data – from the laboratory report ***Solid Poultry Manure***		**Field Identification:**		Example **Units**
Nutrient target rate:	Nitrogen	80	(A)	kg/ha or lb/ac
	Phosphorus (as P_2O_5)	40	(B)	kg/ha or lb/ac
	Other:_____			
Step 2. Manure Test Data				kg/tonne or lb/ton
	% moisture	27.3		
	Total Nitrogen:	50.6	(C)	
	Ammonia Nitrogen:	3.4	(D)	
	Organic Nitrogen (C-D):	47.2	(E)	
	Phosphorus:	21.6	(F)	
	P_2O_5 (F × 2.3):	49.6	(G)	
Step 3. Amount of manure nutrients available to crop:				
	application method:	Broadcast and incorporated 1 day later		
Nitrogen volatilization losses due to application method (Table 8)		25%	(H)	
Organic nitrogen available in first year (E × 0.25)		11.8	(I)	
Ammonia nitrogen available (D × [100 – H]/100)		2.6	(J)	
Total nitrogen available in growing season (I + J)		14.4	(K)	kg/tonne or lb/ton
Phosphorus availability factor:		50%	(L)	
Total available phosphate (G × L/100)		24.8	(M)	kg/tonne or lb/ton
Step 4. Application rate based on N or P requirements:				
Nitrogen target rate (A) ÷ (K) = Application Rate (N) 80 ÷ 14.4 = 5.6		5.6	(N)	tonnes/ha or tons/ac
Phosphorus target rate (B) ÷ (M) = Application Rate (P) 40 ÷ 24.8 = 1.6		1.6	(P)	tonnes/ha or tons/ac
Compare applications rates vs. nutrients (N ÷ P): If (O) is greater than 2.5, then apply the lowest rate		3.5	(O)	
Step 5. Balance nutrients for crop requirements				
	Application rate	1.6	(Q)	tonnes/ha or tons/ac
	Nitrogen applied (K × Q)	23	(R)	kg/ha or lb/ac
	Phosphorus applied (M × Q)	40	(S)	kg/ha or lb/ac
	Nitrogen to add (A - R) → ____ – ____=	**57 lb/ac**		Add as starter fertilizer
	Phosphorus to add (B – S) →____ – ____ =	0		

TABLE 10: MANURE APPLICATION RATE CALCULATION WORKSHEET (template)

Step 1. Soil Test Data – from the laboratory report	**Field Identification:**		
Solid Poultry Manure			**Units**(check one)
Nutrient target rate: Nitrogen		(A)	kg/ha or lb/ac
Phosphorus (as P_2O_5)		(B)	kg/ha or lb/ac
Other:_____			
Step 2. Manure Test Data			kg/tonne or lb/ton
% moisture			
Total Nitrogen:		(C)	
Ammonia Nitrogen:		(D)	
Organic Nitrogen (C-D):		(E)	
Phosphorus:		(F)	
P_2O_5 (F × 2.3):		(G)	
Step 3. Amount of manure nutrients available to crop:			
application method:			
Nitrogen volatilization losses due to application method (Table 8)		(H)	
Organic nitrogen available in first year (E × 0.25)		(I)	
Ammonia nitrogen available (D × [100 – H]/100)		(J)	
Total nitrogen available in growing season (I + J)		(K)	kg/tonne or lb/ton
Phosphorus availability factor:	50%	(L)	
Total available phosphate (G × L/100)		(M)	kg/tonne or lb/ton
Step 4. Application rate based on N or P requirements:			
Nitrogen target rate (A) ÷ (K) = Application Rate (N) ____ ÷ ____ = ____		(N)	tonnes/ha or tons/ac
Phosphorus target rate (B) ÷ (M) = Application Rate (P) ____ ÷ ____ = ____		(P)	tonnes/ha or tons/ac
Compare applications rates vs. nutrients (N ÷ P):		(O)	
If (O) is greater than 2.5, then apply the lowest rate			
Step 5. Balance nutrients for crop requirements			
Application rate		(Q)	tonnes/ha or tons/ac
Nitrogen applied (K × Q)		(R)	kg/ha or lb/ac
Phosphorus applied (M × Q)		(S)	kg/ha or lb/ac
Nitrogen to add (A - R) → ____ – ____ =			Add as starter fertilizer
Phosphorus to add (B – S) → ____ – ____ =			

TABLE 11: RECOMMENDED[1] SETBACK DISTANCES FROM PROPERTY LINES

To animal housing structure	164 ft
To manure storage structures[2]	328 ft

[1]Agencies such as Manitoba Hydro or the rural municipality may have requirements in excess of these.
[2]Requirement of the Livestock Manure and Mortalities Management Regulation 42/98 – see Appendix B

TABLE 12: RECOMMENDED CRITERIA FOR SITING LIVESTOCK OPERATIONS

Animal Units[1] (A.U.)	Maximum Number of Residences[2] Within 1 Mile	Minimum Distance[3], feet (miles)			
		From Single Residence		From Designated[4] Residential or Recreational Area	
		To Earthen Manure Storage	To Buildings and Non-Earthen Storage[5]	To Earthen Manure Storage	To Buildings and Non-Earthen Storage[5]
10 – 100	18	656	328	2640 (1/2)	1760 (1/3)
101 – 200	16	984	492	3960 (3/4)	2640 (1/2)
201 – 400	14	1311	656	5280 (1.0)	3520 (2/3)
401 – 800	12	1639	820	6600 (1 1/4)	4400 (5/6)
801 – 1600	10	1967	984	7920 (1 1/2)	5280 (1.0)
1601 – 3200	8	2297	1148	9240 (1 3/4)	6160 (1 1/6)
3201 – 6400	6	2625	1312	10 560 (2.0)	7040 (1 1/3)
6401 – 12800	4	2953	1476	11880 (2 1/4)	7920 (1 1/2)
12801 and greater	2	3281	1641	13 200 (2 1/2)	8800 (1 2/3)

[1]Refer to Table 3 for number of animals.
[2]Number of residences within one mile of the centre of the facility applies only to new facilities. Expansions of existing facilities and the proponent's residence are excluded.
[3]These separation distances apply to new and expanding operations.
[4]Officially designated areas in a development plan or basic planning statement.
[5]The distance to buildings includes barns, solid manure piles and non-earthen manure storage such as above or below-grade structures, which may be covered or uncovered.

TABLE 13: CONVERTING NUMBER OF ANIMALS TO ANIMAL UNITS

CHICKENS						
Animal Units[1]	**Broilers**	**Roasters**	**Layers**	**Pullets**	**Broiler Breeder Hens**	**Broiler Breeder Pullets**
10 – 100	2000 - 20000	1000 – 10000	1200 - 12000	3000 – 30000	1000 - 10000	3000 - 30000
101 – 200	20001 - 40000	10001 – 20000	12001 - 24000	30001 – 60000	10001 - 20000	30001 - 60000
201 – 400	40001 - 80000	20001 – 40000	24001 - 48000	60001 - 120000	20001 - 40000	60001 - 120000
401 – 800	80001 - 160000	40001 - 80000	48001 - 96000	120001 - 240000	40001 - 80000	120001 - 240000
801 – 1600	160001 - 320000	80001 - 160000	96001 - 192000	240001 - 480000	80001 - 160000	240001 - 480000
1600 and greater	320001and greater	160001 and greater	192001 and greater	480001 and greater	160001 and greater	480001 and greater

[1] Refer to Appendix I for definition of Animal Unit.

TURKEYS			
Animal Units[1]	**Broilers**	**Heavy Toms**	**Heavy Hens**
10 – 100	1000 - 10000	500 -5000	1000 - 10000
101 – 200	10001 - 20000	5001 - 10000	10001 - 20000
201 – 400	20001 - 40000	10001 - 20000	20001 - 40000
401 – 800	40001 - 80000	20001 - 40000	40001 - 80000
801 – 1600	80001 - 160000	40001 - 80000	80001 - 160000
1601 and greater	160001 and greater	80000 and greater	160001 and greater

[1] Refer to Appendix I for definition of Animal Unit.

TABLE 14: NITROGEN STORAGE AND APPLICATION FACTOR

Storage Method	Application Method			
	Injection	Broadcast and Incorporate Within 48 Hours	Broadcast	Sprinkler
I. Liquid Manure Systems				
Enclosed	0.83	0.81	0.64	0.60
Open (except Earthen)	0.78	0.76	0.60	0.56
Earthen	0.59	0.57	0.45	0.42
II. Solid Manure Systems				
Daily Scrape		0.71	0.60	
Manure Pack		0.67	0.56	
Open Lot		0.48	0.40	

TABLE 15: SOIL AND CROP NITROGEN UTILIZATION[1]

Type of Crop	Nitrogen Utilization lb/acre	Soil and Crop Nitrogen Utilization Factor	
		Spring Application	Fall Application
Forages, Established Stands:			
Alfalfa	225	0.71	0.57
Grasses	150	1.07	0.85
Grass - Alfalfa Mixtures	175	0.91	0.73
Annual Crops:			
Medium to Heavy Soils	80	2.00	1.60
Light Soils	60	2.67	2.13

[1] Based upon annual applications.

TABLE 16: ANIMAL UNIT FACTOR

Livestock	Number of A.U. per Livestock[1]
Chickens	
Broilers	0.0050
Roasters	0.0100
Layers	0.0830
Pullets	0.0033
Broiler Breeder Pullets	0.0033
Broiler Breeder Hens	0.0100
Turkeys	
Broilers	0.0100
Heavy Toms	0.0200
Heavy Hens	0.0100

[1] Refers to livestock places or barn capacity.

TABLE 17: LAND BASE REQUIRED[1] FOR MANURE APPLICATION, ACRES

STEP 1:	Determine the total number of animal units produced by the livestock operation. Simply multiply the number of livestock places or barn capacity by the A.U. values in Table 16.		
STEP 2:	Determine the factor for the type of storage and application method, Table 14.		
STEP 3:	Determine the soil and crop utilization factor based upon the soil type, crop and time of application, Table 15.		
STEP 4:	Enter the number of days per year that the livestock production operation is occupied.		
STEP 5:	Multiply the number of animal units produced (Step 1) by the factors in Steps 2, 3 and 4 to determine the number of acres required to utilize the manure from the feeding location.		
STEP 1:	Number of Livestock	_____	(A)
	Animal Unit Factor (Table 16)	_____	(B)
	Total Animal Units (A x B)	_____	(C)
STEP 2:	Storage and Application Factor (Table 14)	_____	(D)
STEP 3:	Soil and Crop Nitrogen Utilization Factor (Table 15)	_____	(E)
STEP 4:	Days in Feeding Location	_____	(F)
STEP 5:	Acres Required for Feeding Location (C x D x E x F ÷ 365)	_____	**ac**

[1] Note that the land base required may change annually as cropping practices change.

TABLE 18: CHARACTERISTICS OF THE MOST DANGEROUS MANURE GASES

GAS	SYMBOL	DENSITY	ODOUR	CONCENTRATION (ppm)[2]		
				TLV-TWA[1]	EFFECT ON HUMANS	
Hydrogen Sulphide	H_2S	1.19	Rotten Eggs, Nauseating	10	5 150 700	Offensive odour Olfactory paralysis, death in 30 minutes Rapidly fatal (Fatal levels commonly observed)
Carbon Dioxide	CO_2	1.53	None	5000	30,000 40,000 300,000	Increased breathing rate Drowsiness, headache May be fatal in 30 min (Fatal levels seldom observed)
Ammonia	NH_3	0.60	Sharp, Pungent	25	100-500 5,000	Irritation of eyes, nose and throat in 30 min Respiratory spasm, may be fatal (Fatal levels rarely observed)
Methane	CH_4	0.55	None		500,000	Could asphyxiate (Fatal levels rarely observed)

[1] TLV-TWA (Threshold Limit Value, Time-weighted Average), the concentration under which nearly all workers may be repeatedly exposed for an 8-h work-day and 40-h work week without apparent adverse effects. Established by the American Conference of Government Industrial Hygienists, P.O. Box 1937, Cincinnati, OH 45201, U.S.

[2] ppm (parts per million) of a gas in atmospheric air; to convert to percentage by volume, divide ppm by 10,000.

Source: Canada Plan Service Plan M-8710 "Manure Gas"

ALTERNATIVE METHODS OF MANURE TREATMENT AND UTILIZATION

INTRODUCTION

To date, many attempts have been made to adapt municipal or industrial waste treatment technologies to dispose of livestock manure. The treatment process may be designed to solve odour problems, recover nutrients or energy from the manure, increase the fertilizer value, reduce the volume, or decrease the pollution potential of the manure to allow safe discharge in the environment. In very intensive production countries, such as the Netherlands, manure management practices are strictly regulated and enforced to minimize pollution problems. In these circumstances, treatment systems can be justified economically. In countries where fuel is very expensive or not readily available, the energy recovered from methane gas production is worth the labour investment.

For the majority of livestock producers in Manitoba, most odour problems can be solved by a combination of good management and the separation of livestock farms from residential areas. Manure produced can be easily disposed of on the available cropland. As long as energy and feed prices are relatively low, the most cost-effective treatment system is storage of the manure, followed by spreading the manure on cropland. In the future, however, there may be circumstances where another method of treatment is desirable. This section will present some of the treatment systems that have been studied and provide a brief outline of the feasibility and possible benefits of each system.

BIOLOGICAL TREATMENT

Aerobic Processes

The aerobic processes that may have some application in Manitoba are biofiltration, storage aeration, pre-storage aeration and composting.

Biofiltration

Biofiltration is a recent waste treatment process where aerobic bacteria growth and activity are promoted by fixing them on very porous and solid media (clay beads, straw stalks, plastic discs, etc.). Once colonies of aerobic bacteria are established on the media, the liquid waste stream is trickled on the bacteria-media matrix, along with a flow of air. Alternatively, the waste stream could be pre-aerated.

Biofilters require backwashing to remove excess bacteria, which would otherwise eventually plug the matrix. This sludge has to be managed either as a waste to recirculate into the treatment system, to be disposed of, or to process. There is no reduction in the volume of liquid to store or apply. Installation and maintenance costs are much higher than the equivalent cost of application.

Sequential Batch Reactors

Sequential batch reactors are also relatively compact waste treatment systems, where the growth of aerobic bacteria is controlled for efficient biodegradation of organic matter and denitrification of nitrogen in the liquid.

A series of tanks are typically used. In the first one, a mixture of bacteria is entered (or reintroduced by recirculation) into the aerated and agitated waste stream. The liquid waste is either held in this tank for sufficient time

to allow maximum bacterial activity, or else transferred to a holding tank for this purpose. Most systems are designed to allow strong nitrification (conversion of organic nitrogen and ammonia into nitrates). The liquid stream is then allowed to settle in an idle tank, where denitrifying bacteria convert nitrates into, ideally, elemental nitrogen and solids (small clumps of bacteria) can settle. The treated liquids are then disposed of separately from the settled solids (sludges). The economical feasibility of this system for livestock manure has not yet been proven anywhere in Canada.

Storage Aeration

Storage aeration is used to maintain the manure in an aerobic state. When manure has sufficient amounts of oxygen present, very little odour is produced, and a significant amount of nitrogen can be removed from the manure by micro-organisms. Where the land base available for spreading is limited, it may be necessary to try to reduce the nitrogen content of the manure before it is spread on the land. However, in most parts of Manitoba, the manure has value as a source of nutrients for plants, and the land base is large enough to spread all the manure produced without risk of pollution.

During the summer, liquid manure can be treated aerobically by using mechanical aeration equipment. Mechanical aerators operate by either pumping air bubbles into the manure, or by spraying the manure into the air. A high-energy input is required to supply enough oxygen to the manure and keep the manure well mixed, and as with all mechanical equipment, a certain amount of maintenance is required to keep the system functional. The energy costs and labour requirements needed to keep a large volume of manure aerobic are high. Generally, total aeration is used only when the manure is to be spread in an area where odour control is important and soil incorporation is not possible. It is not practical to aerate manure that has been collected and stored under anaerobic conditions during the winter. Aeration is feasible only when the storage is emptied in the spring and fall, and aeration is used as a method of odour control during the summer.

Another alternative is partially aerated storage. In this system, a mechanical aerator supplies enough oxygen to keep the upper layer of the manure aerobic. When the system is functioning properly, the manure at the bottom of the storage is decomposed anaerobically and the gases released from the decomposing manure at the bottom are absorbed and further decomposed as they rise toward the top, preventing odorous gases from being released. If the mechanical aerator fails to supply enough oxygen, or if the manure is not properly mixed, then offensive odours will be released. This method of treatment has not proven effective in Manitoba.

In Manitoba, liquid-manure storage aeration systems are not commonly used. The cost of aerating the manure and maintaining the equipment is high. A major disadvantage of storage aeration is the loss of significant amounts of ammonia nitrogen, one of the most valuable plant nutrients in liquid manure. It is usually less expensive to control odours by building a livestock operation in an isolated area, or by covering storage structures.

Pre-Storage Aeration

Another method of controlling odours from stored liquid manure is pre-storage aeration. A treatment tank is used to hold seven days of manure production. The manure is partially decomposed under warm, aerobic conditions, and then transferred to the long-term storage. Although the manure is held anaerobically in the long-term storage, the odour level is reduced because the manure is partially decomposed. The success of this system under Manitoba conditions is unproven.

Composting

Composting is a biological process in which micro-organisms aerobically convert organic materials into a soil-like material called compost. During composting, the micro-organisms consume oxygen while feeding on

the organic matter and generate heat and large quantities of carbon dioxide and water vapour. The rate at which manure will compost depends upon the moisture content, the temperature, the level of oxygen available, the size of the manure particles and the relative quantities of carbon and nitrogen available to the micro-organisms for use as food. The optimum solids content for composting is between 40 and 50 per cent. In the case of poultry production, it is necessary to increase the solids content of bird manure from its normal 10 per cent solids to at least 35 per cent before it can be composted. The fresh manure can be screened and the resulting solids, which are about 35 per cent moisture, composted directly. The liquids are collected and sent to storage. It is also possible to add some form of bulking agent, such as straw or sawdust, to adjust the moisture content before beginning composting. During the composting process, the volume of manure will be reduced by up to 50 per cent. Considerable losses of nitrogen also occur during the process.

In order to provide the conditions for composting, it is necessary to ensure an adequate supply of oxygen throughout the pile, maintain the pile at 40 - 50 per cent solids and mix the material on a regular basis. This process can be carried out using a windrow system, aerated static piles or an in-vessel system. The windrow method consists of placing the mixture of raw materials in long narrow rows (typically 1.0 to 1.2 m high and 2.6 to 3 m wide). The windrows are then turned on a fixed schedule to increase aeration and rebuild the bed porosity. Aerated static piles are aerated directly with forced-air systems to speed up the process. The in-vessel system confines the composting material within a building or container and uses forced aeration and mechanical turning to speed up the composting process.

Windrow composting generally takes from 1 to 4 months, depending on the frequency of turning, and in-vessel composting or aerated static piles range from 2 to 4 weeks. When managed properly, the composting process is aerobic, the release of odours should be minimal and the product will have an earthy odour. If the conditions are not controlled and the manure begins to decompose anaerobically, very strong, offensive odours can be produced and the process can take much longer.

So far, the markets for composted livestock manure are limited and the costs of composting may not be recoverable in the sale of the final product.

Anaerobic Processes

With controlled anaerobic treatment processes, such as anaerobic lagoons and anaerobic digesters, the temperature and the nutrient levels of the manure are regulated so that only desirable gases and end-products are produced. Whenever manure is stored in a pit or a pile, the manure decomposes anaerobically, but because the process is not controlled, many different gases can be formed.

The type of gases and end products formed by the anaerobic decomposition will depend upon the temperature and characteristics of the manure. The most common anaerobic process is carried out at mesophilic temperatures (30-35° C), which allows rapid growth of methane-forming bacteria. Alternatively, thermophilic digestion is also used for biogas production, where temperatures are kept between 60 to 65° C. Thermophilic digestion tends to be less stable than digester operation at mesophilic temperatures. More recently, bacteria strains were selected for a strong activity at psychrophilic temperatures (10 - 20° C) with liquid hog manure.

Anaerobic Lagoons

Anaerobic lagoons are often confused with earthen manure storages. Lagoons are carefully designed and managed to maintain optimum loading rates, retention time and temperature of the manure to maintain a balance between the acid-forming and methane-forming bacteria. Earthen manure

storage structures are simply basins designed to store the manure between periods of land application. Lagoons have been used successfully in warmer climates, but in Manitoba where low temperatures occur for much of the year, the methane-forming bacteria become inactive and the rate of decomposition is slow, with the result that lagoons fill rapidly with solids that do not become stabilized. During the spring, when the manure temperature begins to increase, the acid-forming, rather than the methane-forming bacteria become active and begin to decompose the manure accumulated over the winter. When this occurs, the system is unbalanced and offensive odours are produced.

Anaerobic Digesters

Anaerobic digesters are used to produce and recover methane gas from the decomposition of manure. Digesters consist of a large, airtight tank with devices for controlling the input of fresh manure into the tank, mixing the manure, maintaining the correct temperature, and drawing off methane gas and components of the digested manure. Methane production is affected by the temperature, loading rate, mixing, digestion time and characteristics of the manure. To optimize the amount of methane produced by a digester, all the factors mentioned above must be carefully controlled. The control of these factors can be accomplished by a lot of labour or by mechanization. In most regions of Canada, much of the methane produced needs to be used to warm up the digester to sustain mesophilic or thermophilic operation. Unfortunately, both approaches are costly when compared with the value of the methane gas recovered. The methane produced by anaerobic digestion has a low energy level per unit volume, making storage expensive, so its use is limited to stationary applications such as space heating.

Considerable research and development is still taking place on anaerobic digestion. The main agronomic advantage of this process is that the organic nitrogen in liquid manure is mineralized, which reduces subsequent odour production during storage. A project is under way in Canada to adapt the concept of psychrophilic digestion to the scale of individual swine operations.

In the past there has been a great deal of interest in methane gas production. This alternative is usually not economically viable for Manitoba. The same volume of liquid manure remains to be stored and field applied after treatment. Anaerobic digestion results in a very slight reduction in total nutrient content, even if more stable and less odorous. The high capital costs for equipment, combined with high management requirements, make this system impractical. At present, other energy forms such as electricity are less expensive and much more versatile, when considering only biogas energy production as a justification.

PHYSICAL TREATMENT

Refeeding

Attempts have been made to recover some of the nutrients and energy contained in livestock manure by feeding them back to livestock. Some form of treatment is required to improve animal acceptability, destroy pathogens and reduce odours. These forms of treatment include dehydration, treatment with formaldehyde and formalin, fermentation and aerobic treatment. While there have been situations on experimental farms where liquid wastes have been re-fed to swine and poultry, there is considerable debate regarding the value of this practice on commercial livestock farms. Generally, refeeding is most successful when the manure from monogastric species such as swine, is re-fed to a ruminant species such as cattle. The handling of recycled manure presents problems, since most feeding systems are designed for dry rations. In Manitoba, the low cost of feed ingredients, combined with the risk of disease transmission make the possibility of future acceptance unlikely until an improved process is developed.

Dehydration

Dehydration is a process that can be used for odour control. Dry manure does not support the growth of either micro-organisms or insects such as flies. As well, dry manure can be used as a soil conditioner, in much the same way as composted manure. The problem with dehydration is that the costs associated with moisture removal are high and cannot be fully recovered from the sale of the final product.

Solids Separation

There are several benefits from separating the solid and the liquid portions of livestock manure. In some manure-handling systems, it is sometimes desirable to recycle the liquids for flushing. Another reason for separation of the solids from the liquid manure is to allow the use of different treatment processes. Since most of the phosphorus is associated with the solids in liquid manure, separation is also considered as an alternative approach to phosphorus management. Removing the solids can serve a similar function to pre-storage aeration. The remaining liquid is less concentrated and therefore will produce less odour when it decomposes. Depending upon the degree of separation, the solids may be dry enough to be composted, and the remaining liquid will be easier to handle when spreading on the land or aerating. The disadvantage of solids separation is the need for two separate manure-handling systems.

Most long-term storage structures for liquid manure allow natural separation of the solids, as they effectively settle at the bottom of the structure after 200 or more days of storage. Separation can be done using filters or screens, or by allowing the solids to settle in a large tank or basin while removing the liquids from the top. Mechanical equipment is available, including centrifuges, cyclone separators, stationary and vibrating screens, in a variety of sizes. Depending upon the flow rate and the type of mechanical equipment used, up to 50 per cent of the solids can be removed. Settling basins can remove up to 95 per cent of the solids, depending upon the design.

A method of separation that has been used in Manitoba is to transfer the fresh liquid manure to a covered concrete structure, where the solids are separated by settling. Conventional manure pumps are then used to agitate and remove the solids. The liquids are transferred from the concrete tank to an uncovered earthen manure storage. This system has the benefit of using low-cost, open storage for the large volume of liquids having a low nuisance potential, and a higher-cost, covered storage for the smaller volume of highly concentrated manure, which can produce the most offensive odours. Alternatively, two-cell earthen storage structures will also separately store solids and liquids; the first cell could possibly be covered. However, the effectiveness of this method of separation for odour control has not been quantified.

Oligolysis

This process is designed to essentially destroy odour-forming micro-organisms in liquid manure via the action of metallic ions. These metallic ions are generated with copper or steel electrodes placed at various locations in the storage structure. This process is at the marketing stage in Eastern Canada, but its effects need to be further clarified. The environmental impacts of the added metal ions in the manure also have to be determined.

NITROGEN LOSS SUMMARY
(Per cent Loss)

LIQUID SYSTEMS

Storage[1]	N loss (%)
Enclosed	10 - 20
Open	10 - 30
Earthen	30 - 50
Application	
Broadcast	20 - 30
Broadcast & Incorporate Within 24 Hours	1 - 5
Injection	0 - 2
Irrigation (sprinklers)	25 - 35

SOLID SYSTEMS

Storage[1]	N loss (%)
Daily Scrape	15 - 35
Manure Pack	20 - 40
Open Lot	40 - 60
Application	
Broadcast	15 - 30
Broadcast & Incorporate Within 24 Hours	1 - 5

[1] Losses can vary widely, depending on climatic and management factors. The values in this table are based on typical practices.

[2] Nitrogen losses after fall applications will be approximately 20 per cent greater than spring or summer applications.

APPENDIX F

SOIL SAMPLING PROCEDURES

WHY IS SOIL AND WATER SAMPLING NECESSARY?

Throughout the world increasing attention is being directed toward the sustainability of our environment. Water quality is high on the list of concerns, reflecting its importance to the maintenance of life.

Agricultural practices that have the potential to influence surface and groundwater quality include summerfallowing and the frequent application of high rates of chemical fertilizers and/or manure. These practices can lead to the contamination of groundwater due to leaching, which is the downward movement of soluble materials. The nutrient of most concern is nitrate-nitrogen, more commonly referred to as "nitrates." Once these nitrates have leached below the rooting depth of crops, they will continue to move slowly downward toward the water table.

The impact of agriculture on groundwater quality in the Prairie provinces has not been considered a high risk because of our harsh winters and relatively low annual precipitation. The Atlantic provinces, areas of Quebec, Ontario, British Columbia and Europe, as examples, have high rainfalls and milder winters. In these areas extensive nitrate leaching can occur after harvest to freeze-up, during extended mid-winter thaws and again in the spring.

Groundwater nitrate problems in Manitoba have generally been confined to local sites within sensitive groundwater areas. Recent studies of the nitrate distribution in the upper 3.6 m (12 ft) of soil beneath cropland, however, have indicated high subsoil nitrate concentrations in some areas. In most of these areas manure or inorganic fertilizers have been applied at excessive rates.

In order to avoid the accumulation of subsoil nitrates, **manure and inorganic fertilizers should be applied to cropland only at rates that do not exceed crop nitrogen requirements**. Using this simple principle, manure and other fertilizers can be applied on a wide range of soils and crops with minimal threat to groundwater quality.

Monitoring, via annual soil testing, is recommended to ensure that nitrogen availability does not exceed anticipated crop uptake. Fertilizer and manure application rates can then be tailored to meet crop requirements. A professional agrologist, the laboratory conducting the soil testing or Manitoba Agriculture and Food should be contacted for detailed recommendations.

Actual crop nitrogen uptake can vary from predicted uptake based on factors such as weather and plant diseases. In addition, variations in the nitrogen content of manure can result in slight over or under-application of manure. Monitoring the top 60 cm (2 ft) of the soil profile through annual soil testing allows producers to make ongoing corrections and adjustments, ensuring that excess levels of nitrates do not build up.

THE SOIL SAMPLING PROGRAM

I. Initial Deep Monitoring

This is recommended for fields about which little is known regarding past fertilization practices or which are suspected of having received high applications of nitrogen (inorganic or manure). The objective of this sampling is simply to determine what now exists in the soil. Suitable crops and manure application rates can then be tailored to any unusual situations that may be encountered.

Sampling procedure:

- Follow the general instructions under the following section *Soil Sampling Procedure* or refer to Manitoba Agriculture and Food's fact sheet *Soil Sampling Strategies for Site Specific Management.*
- Sample one location per 6 hectares (15 acres). A minimum of 15 sample locations per field is required.
- Each location should be investigated to a depth of 3.6 m (12 ft).
- Form one composite sample for each 30 cm (1 ft) increment by combining soil from all locations.
- Have the sample analyzed for nitrate-nitrogen and soil moisture content.

Interpreting the Results:

If any one of the following two criteria is exceeded, seek the services of a professional agrologist to determine recommended cropping and fertilization practices. Deep-rooted perennial crops such as alfalfa can be grown to recover nitrates.

- The nitrates accumulated between 0 and 1.2 m (4 ft) below the surface should not exceed 160 kg/ha (150 lb/ac).
- The nitrates accumulated between 1.2 and 3.6 m (4 and 12 ft) below the surface should not exceed 22 kg/ha (20 lb/ac) in each 30 cm (1 ft) increment.

II. Annual Soil Sampling

This simply consists of conducting soil testing which is considered a good agronomic practice.

Sampling Procedure:

- Follow the general instructions under the following section *Soil Sampling Procedure* or refer to Manitoba Agriculture and Food's fact sheet *Soil Sampling Strategies for Site Specific Management.*
- Sample annually in late fall or just prior to manure application - turnaround time for soil test results is typically 10 to 14 days.
- Sample one location per 2 hectares (5 acres) to a depth of 60 cm (2 ft). A minimum of 15 sample locations per field is required. Two composite samples are suggested, one for the 0 to 15 cm (0-6") layer and a second for soil between 15 to 60 cm (6-24").
- Follow standard recommended soil testing procedures for obtaining and handling samples.
- Have the samples analysed for nitrate-nitrogen and soil moisture content.

MAXIMUM ALLOWABLE NITRATE-NITROGEN IN THE TOP 60 CM (2 FT) OF SOIL UNDER THE LIVESTOCK MANURE AND MORTALITIES MANAGEMENT REGULATION.

Crop	Soil Type	Maximum Nitrate-Nitrogen (kg/ha)	(lb/ac)
Alfalfa	All types	309	275
Grasses	All types	224	200
Alfalfa-Grass Mixtures	All types	224	200
Annual Crops	Medium to heavy soils	157	140
Annual Crops	Light soils	101	90

Interpreting the Results:

- The nitrates accumulated in the 0 and 60 cm (2 ft) soil profile depth must not exceed the criteria prescribed in the Livestock Manure and Mortalities Management Regulation (see Appendix B), as outlined in the previous table.

III. Five-Year Monitoring

Once every five years additional sampling should be undertaken, especially in areas situated over sensitive aquifers. This is in addition to the annual monitoring described above.

Sampling Procedure:

- Follow the general instructions under the following section *Soil Sampling Procedure* or refer to Manitoba Agriculture and Food's fact sheet *Soil Sampling Strategies for Site Specific Management*.
- Sample one location per 4 hectares (10 acres). A minimum of 15 sample locations per field is required.
- Form one composite sample for the 0 to 1.2 m (0 to 4 ft) depth with the material collected from all locations.
- Have the sample analysed for nitrate-nitrogen and soil moisture content.

Interpreting the Results:

The total nitrates in the 0 to 1.2 m (0 to 4 ft) depth should not exceed 160 kg/ha (150 lb/ac). Deep-rooted crops such as alfalfa can be grown to recover nitrates.

SOIL SAMPLING PROCEDURE

Reliable results can be made only if the samples are fully representative of the field or area from which they are taken. In addition, proper sampling and sample handling procedures must be followed.

Selecting Areas to Sample

Soil sampling is normally done on an individual-field basis, with a single composite sample representing the whole field. Individual fields that are not uniform should be divided into smaller sampling units, with a single composite sample representing each unit. The soil in each of these sampling units should have the same colour, texture, cropping history, and fertilizer or manure treatments. Look for differences in slope, erosion, crop growth and yield. Any area that is different in these features and is large enough to have manure applied at a different rate should be sampled separately.

Problem areas such as saline spots, poorly drained potholes, and eroded knolls should not be sampled unless they represent a significant portion of the field. If they do, obtain separate samples.

All abnormal areas, such as old manure piles, burnpiles, haystacks, corrals, fence rows or farmstead sites, should also be avoided, as well as locations of past chemical or fertilizer spills. Samples should not be taken along headlands, within 15 m (50 ft) of field borders or shelterbelts, or within 45 m (150 ft) of built-up roads.

If the field has been cultivated, take the sample from the compacted soil in wheel track.

Sample one location from every 2 to 6 hectares (5 to 15 acres), depending upon whether the monitoring is initial, annual or five-year. In all cases, however, a minimum of 15 sample locations per individual field or sampling unit should be taken. A single composite sample is then formed from 15 or more samples.

Equipment and Supplies

Special augers or probes designed for soil sampling must be used. These may be hand or hydraulic-powered and are often available from fertilizer dealers. Independent firms may also be available to custom sample fields.
Use two clean, labelled plastic pails for collecting samples. Information sheets, sample containers and shipping boxes are available from the lab conducting the analysis.

Note: Mechanical and hydraulic samplers may yield poor samples on very dry or wet soils. In all cases avoid getting topsoil in the subsoil samples, or subsoil in the topsoil samples. (For example, in very dry soils, be careful not to let topsoil spill into the hole before taking deeper samples).

Handling Samples

Take care to keep samples clean and uncontaminated. Clean the probe and take a couple of dummy samples between fields.

Send samples to the laboratory immediately. If this is not possible, or if a delay of more than 48 hours is expected, freeze or dry the samples. Follow these steps to dry samples:

- Mix the soil in each container thoroughly, breaking lumps so they are less than 12 mm (1/2 inch).
- Remove about 0.5 L (1 pint) of soil and spread on a piece of clean paper.
- Completely dry at a temperature of not more than 30°C. Do not dry in an oven at a high temperature, since this can change the phosphorus, potassium and sulphur levels.
- Take care to avoid contamination of the samples with foreign materials such as commercial fertilizer, manure, salt, baking soda, water, dust, etc. Samples should not be dried on old fertilizer or feed bags, or in areas where fertilizers have been handled.
- A fan may be used to ensure constant air flow over samples and enhance drying.

Once the sample is thoroughly dry, fill the soil sample cartons. Label each carton with the correct field number and sample depth. Complete an information sheet for each field.

Keeping Records

It is wise to keep past records on fields sampled. The records should include:

- fertilizer and manure application rates;
- previous soil test results;
- soil condition at sampling (temperature, moisture, crop cover, etc.);
- a map of where the soil samples were taken in each field (preferably geo-referenced using GPS); and
- production information.

These records may give clues to variations in lab results from year to year, and allow for customizing manure application recommendations.

GROUNDWATER MONITORING

If regular monitoring of nitrogen levels in soil is carried out as suggested above, in most situations the accumulation of excessive nitrogen levels in the soil zone will be detected before significant movement of contaminants into underlying groundwaters has occurred. Changes in cropping or fertilization practices can then be undertaken to remove the excess soil nitrogen and prevent a continuing buildup of nitrogen levels. Soil monitoring therefore, is not only good agronomic practice, but also a proactive approach to the prevention of groundwater contamination.

When proper soil nitrogen monitoring is undertaken, groundwater monitoring is considered necessary only in unique or especially sensitive groundwater situations. If

groundwater monitoring is undertaken, however, the monitoring network should be designed only after a thorough study of groundwater conditions and flow in the area. This must be undertaken by a qualified specialist.

SUMMARY

The monitoring program described here should ensure the protection of groundwater underneath agricultural fields fertilized with inorganic fertilizers and/or livestock manure. Producers who apply fertilizers, including manure, to cropland at recommended rates can be reassured that they are farming in an environmentally responsible manner.

SUMMARY TABLE

A Metric	Number of Locations[1]	Sampling Depth	Number of Samples	Maximum Nitrate-Nitrogen that should be found
I Initial Deep Monitoring	1 per 6 ha	3.6 m	One composite sample for each 30 cm increment	0 to 1.2 m - 160 kg/ha 1.2 to 3.6 m – 22 kg/ha per 30 cm
II Annual Monitoring	1 per 2 ha	60 cm	One composite sample, 0 to 15 cm One composite sample, 15 to 60 cm	See section 12, Appendix B
III Five-Year Monitoring	1 per 4 ha	1.2 m	One composite sample, 0 to 1.2 m	160 kg/ha
B Imperial				
I Initial Deep Monitoring	1 per 15 ac	12 ft	One composite sample for each 1 ft increment	0 to 4 ft - 150 lb/ac 4 to 12 ft - 20 lb/ac per ft
II Annual Monitoring	1 per 5 ac	2 ft	One composite sample, 0 to 6 in One composite sample, 6 to 24 in	See section 12, Appendix B
III Five-Year Monitoring	1 per 10 ac	4 ft	One composite sample, 0 to 4 ft	150 lb/ac

[1] In all situations a minimum of 15 sample locations are required.

MANURE MANAGEMENT PLAN REGISTRATION FORM

The following form reproduces the 2000 version of the registration form. Please contact your Manitoba Conservation regional office to inquire about potential changes to the form before using it for registration purposes. The same office can provide you with the latest form to that effect.

MANURE MANAGEMENT PLAN

All livestock operations in Manitoba with 400 animal units (A.U.) or more are required under Section 13(1) of The Livestock Manure and Mortalities Management Regulation, MR 42/98 under The Environment Act, to submit an annual manure management plan to Manitoba Conservation, at least 60 days prior to the application of manure to fields. If you require technical assistance, please contact your local Manitoba Agriculture and Food District Office or consult a professional agrologist. **Please complete this form and forward to the Environment Livestock Program, Manitoba Conservation, 284 Reimer Ave, Unit 5, Box 21450, Steinbach MB R0A 2T3. Phone: 204-346-6060/Fax: 204-326-2472**

Proprietary (confidential) and personal information will be protected in accordance with Manitoba law.

Name of operation (legal name) _____

Location of operation _____
Qtr Sec Twp Rge E/W or River Lot and Parish

_____
Municipality

Mailing Address _____
Street or box number

_____
City/Town/Village

_____
Postal Code

Name of operator _____

Contact Numbers

_____ _____
Business Residence

_____ _____
Cell Fax

FOR GOVERNMENT USE ONLY

Received by: _____ Date: _____

Office: _____

Follow-up required: Yes ☐ No ☐

Nature of follow-up: _____

_____

_____

ANIMAL UNIT[1] (A.U.) INVENTORY LIST

	A.U. Produced by One Livestock		Number of Livestock of Each Type	A.U. for Each Livestock Type		
Dairy Milking Cows (including associated livestock)	2.000	X	_____	=_____	Days in confinement[2] _____	Days out in pasture _____
Beef						
Beef Cows[3], inc. associated livestock	1.250	X	_____	=_____	_____	_____
Backgrounder[4]	0.500	X	_____	=_____	_____	_____
Summer pasture/replacement heifers[4]	0.625	X	_____	=_____	_____	_____
Feedlot cattle[5]	0.769	X	_____	=_____	_____	XXXXXX
Hogs						
Sows, farrow to finish	1.250	X	_____	=_____		
Sows, farrow to weanling	0.313	X	_____	=_____		
Sows, farrow to nursery	0.250	X	_____	=_____		
Weanlings	0.033	X	_____	=_____		
Grower/finishers	0.143	X	_____	=_____		
Boars (artificial insemination operations)	0.200	X	_____	=_____		
Chickens						
Broilers	0.0050	X	_____	_____		
Roasters	0.0100	X	_____	_____		
Layers	0.0083	X	_____	_____		
Pullets	0.0033	X	_____	_____		
Broiler Breeder Pullets	0.0033	X	_____	_____		
Broiler Breeder Hens	0.0100	X	_____	_____		
Turkeys						
Broilers	0.010	X	_____	_____		
Heavy Toms	0.020	X	_____	_____		
Heavy Hens	0.010	X	_____	_____		
Horses (PMU)						
Mares, including associated livestock	1.333	X	_____	_____		
Sheep						
Ewes, including associated livestock	0.200	X	_____	_____		
Feeder lambs	0.063	X	_____	_____		
Other livestock or operation type - please inquire with your regional agricultural engineer or livestock specialist						

[1] One animal unit is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12 month period; please refer to the *Farm Practices Guidelines for Beef/Dairy/Hog/Poultry Producers in Manitoba* for more information.
[2] For livestock kept in confined livestock areas e.g. wintering corrals or paddocks and on pasture, report days in confinement and days on pasture.
[3] Do not include calves or replacement heifers; e.g. for 100 cow calf pairs with 30 replacement heifers, simply enter 100.
[4] Weaned calves; do not include cow numbers.
[5] Cattle on finishing rations intended for slaughter.

MANURE SYSTEM INFORMATION

TYPE OF LIVESTOCK (One page per type; please reproduce page 3 and 4 for each type of livestock with 400 A.U. or more on the farm.)

_____

_____

TYPE OF STORAGE SYSTEM

	☐ Enclosed		☐ Daily scrape
Liquid System	☐ Open (except earthen)	**Solid System**	☐ Manure pack
	☐ Earthen		☐ Open lot

Volume of Manure to be Land Applied

_____

☐ Imp. Gallons (liquid manure)

☐ Tons (solid manure)

☐ Cubic feet

Manure Analysis

Actual (1) or estimated (2) total nitrogen content in the manure _____

☐ lb/1000 gal

☐ lb/ton

(1) Please attach manure analysis report with this form.

(2) If estimated, please indicate your source of information:

☐ *Farm Practices Guidelines for Beef/Dairy/Hog/Poultry Producers in Manitoba*

☐ Average values published by analytical laboratory (specify laboratory): _____

☐ Other source (specify): _____

Field Application Details

Time of Application

☐ Spring

☐ Summer

☐ Fall

Application method

☐ Broadcast

☐ Broadcast and incorporate within 48 hours

☐ Injection

☐ Irrigation/sprinkler

Producer application ☐

Custom application ☐ Name of applicator: _____

Anticipated Manure Application Starting Date: _____

Fields to be manured must be soil sampled and the analytical reports submitted to Manitoba Conservation. Sound soil sampling procedures, as outlined on page 6 of this form, are required to obtain an accurate soil nutrient assessment.

MANURE MANAGEMENT PLAN

Crop year for which manure will be applied: _____

Livestock type: _____ Manure Form (liquid/solid): _____

Field Application Summary

Legal Description	Legal Owner's Name	Field size[1] (acres)	Soil Texture[2] L or MH	Crop	Soil Nitrate Nitrogen[3] (0-24") ☐ lb/acre	Target Yield ☐ bu/acre ☐ lb/acre ☐ tons/ac	Crop Nitrogen[4] Recommendation (lb/acre)	Manure Application Rate ☐ gal/acre ☐ tons/acre	Additional Nitrogen Fertilizer (lb/acre)

[1] Indicate only the available acres for manure spreading (exclusive of setbacks from surface water courses, etc.).
[2] For loamy sand to sand, indicate as light texture (L) and for sandy loams to clays, as medium to heavy (MH).
[3] As shown on the soil analysis report appended to this form. If soil analysis reports are not available at the time of submitting the form, they **must** be forwarded to Manitoba Conservation **before** application of manure.
[4] Indicate the recommended nitrogen (N) application rate suggested in the soil analysis report.

I certify that the statements and information in this plan are true and that no relevant information has been withheld.

_____ _____

Signature of Operator Date

Prepared by: _____

INSTRUCTIONS FOR FILLING OUT THE MANURE MANAGEMENT PLAN

ANIMAL UNIT (A.U.) INVENTORY LIST

- Determine the category in which your livestock operation fits.
- Calculate and indicate the A.U.'s for each type of livestock in your operation.
- If you are unsure as to which category your livestock operation fits into, contact your Regional Agricultural Representative office or Regional Manitoba Conservation office.
- Do not double count animals.

MANURE SYSTEM INFORMATION

- Ensure one page is submitted for each type of livestock in your operation with 400 or more animal units (A.U.)
- Manure analysis section:
  - ◊ Ensure manure nitrogen ("N_{total}") content is filled out on this form.
  - ◊ If manure has been sampled, obtain manure nitrogen content from the analysis report and attach a copy of the analysis report.
  - ◊ If manure nitrogen content is being estimated, please use a reliable source of information and indicate this source on the plan.
  - ◊ If you require assistance arriving at this estimate, please contact your Regional Agricultural Representative office or Regional Manitoba Conservation office.
  - ◊ If the manure is being checked in the field by a custom applicator, please indicate in this section.

MANURE MANAGEMENT PLAN

- Ensure one page is submitted for each type of livestock operation with 400 or more animal units (A.U.).

"Field Size" Column

- ◊ Indicate only the field acreage on which manure will be applied, considering recommended setbacks and excluding land that may not be suitable for application (e.g. low areas, brush, sink holes, etc.).

"Soil Texture" Column

- ◊ Note that Manitoba Conservation Regulations make provisions for two classifications of soil:
  - medium to heavy textured soils (sand loam to clay), indicated as "MH";
  - lighter texture soils (loamy sand to sand), indicated as "L".
- ◊ Indicate in soil column which category each parcel would fall into.
- ◊ Soil texture analysis may be required to determine which of those classifications best describes your soil.

If you require assistance in determining a classification, contact your Regional Agricultural Representative office or Regional Manitoba Conservation office.

"Soil Nitrate Nitrogen" Column

- ◊ This information can be obtained from the soil analysis report.
- ◊ Ensure soil testing procedures as indicated on the attached sheet have been followed.
- ◊ Ensure you attach a copy of the soil analysis reports to this plan.

"Target Yield" Column

- ◊ Indicate anticipated target yield for the crop year on that site.
- ◊ Contact your Regional Agricultural Representative office or Regional Manitoba Conservation office, should you have difficulty in estimating this target yield.

"Crop Nitrogen Recommendation" Column

- ◊ This information can be obtained from the soil analysis report;
- ◊ If you have any difficulty interpreting this report, please contact your Regional Agricultural Representative office or Regional Manitoba Conservation office.

"Manure Application Rate" Column

- ◊ Report your intended application rate in gallons per acre (or tons per acre). Your Regional Agricultural Representative office or a professional agrologist can also be of assistance for this step.

"Additional Nitrogen Fertilizer" Column

- ◊ If applicable, please indicate the amount of commercial fertilizer that will be applied in addition to the manure.

Please ensure that this Manure Management Plan, completed and signed, is submitted along with all the required analysis reports to the Environment Livestock Program at Manitoba Conservation, 284 Reimer Ave, Unit 5, Box 1450, Steinbach, MB R0A 2T3 (Phone: 204-346-6060/Fax: 204-326-2472) at least 60 days prior to the beginning of land application.

TRADITIONAL COMPOSITE SOIL SAMPLING PROCEDURE

Other acceptable soil sampling procedures include the "Benchmark" soil sampling procedure, the "Grid" soil sampling procedure and the "Landscape Directed" soil sampling procedure. Additional information on these procedures can be obtained from your local Manitoba Agriculture and Food office or your Regional Manitoba Conservation offices.

Reliable results can only be made if the samples are fully representative of the field or area from which they are taken. In addition, proper sampling and sample handling procedures must be followed.

Selecting Areas to Sample

Soil sampling is normally done on an individual field basis with a single composite sample representing the whole field. Individual fields which are not uniform should be divided into smaller sampling units with a single composite sample representing each unit. The soil in each of these sampling units should have the same colour, texture, cropping history and fertilizer or manure treatments. Look for differences in slope, erosion, crop growth and yield. Any area that is different in these features and which is large enough to have manure applied at a different rate should be sampled separately. Problem areas such as saline spots, poorly drained potholes, and eroded knolls should not be sampled unless they represent a significant portion of the field. If they do, obtain separate samples. All abnormal areas such as old manure piles, burn piles, haystacks, corrals, fence rows or farmstead sites should also be avoided as well as locations of past chemical or fertilizer spills. Samples should not be taken along headlands, within 15 metres (50 ft) of field borders or shelterbelts or within 45 metres (150 ft) of built up roads. If the field has been cultivated, take the sample from the compacted soil in the wheel track.

Sample one location per 2 hectares (5 acres) to a depth of 60 cm (2 ft). In all cases, however, a minimum of 15 sample locations per individual field or sampling unit should be taken. A single composite sample is then formed from 15 or more samples.

Equipment and Supplies

Special augers or probes designed for soil sampling must be used. These may be hand or hydraulic powered and are often available from fertilizer dealers. Independent firms may also be available to custom sample fields. Use two clean, labeled plastic pails for collecting samples. Information sheets, sample containers and shipping boxes are available from the lab conducting the analysis.

Note that all mechanical and hydraulic samplers may yield poor samples on very dry or very wet soils. In all cases avoid getting the topsoil in the subsoil samples, or subsoil in the topsoil samples. For example, in very dry soils, be careful not to let topsoil spill into the hole before taking deeper samples.

Handling Samples

Take care to keep samples clean and uncontaminated. Clean the probe, take a few samples from the new field and discard them before proceeding with actual sampling. Send samples to the laboratory immediately. If this is not possible or if a delay of more than 48 hours is anticipated, freeze or dry the samples. Follow these steps to dry samples:

- mix the soil in each container thoroughly, breaking lumps to less than 12 mm (1/2 inch);
- remove about 0.5 litre (1 pint) of soil and spread on a piece of clean paper;
- completely dry at a temperature of not more than 30ºC (do not dry in an oven at a high temperature since this can change the phosphorus, potassium, and sulphur levels);
- care should be taken to avoid contamination of the samples with foreign materials such as commercial fertilizer, manure, salt, baking soda, water, dust, etc. (e.g. samples should not be dried on old fertilizer or feed bags or in areas where fertilizers have been handled);
- a fan may be used to ensure constant air flow over samples and enhance drying.

Once the sample is thoroughly dry, fill the soil sample cartons. Label each carton with the correct field number and sample depth. Complete an information sheet for each field.

MANITOBA CONSERVATION - REGIONAL OFFICES

Eastern-Interlake Region Unit 5, 284 Reimer Ave Box 21450 Steinbach MB R0A 2T3	PH: Fax:	346-6060 326-2472	Eastern-Interlake Region 102-235 Eaton Ave Selkirk MB R1A 0W7	PH: Fax	785-5030 785-5024	Winnipeg Region 123 Main St., Suite 160 Winnipeg MB R3C 1A5	PH: Fax:	945-7100 948-2420
South-Central Region 25 Tupper St. N. Portage la Prairie MB R1N 3K1	PH: Fax:	239-3188 239-3185	South Central Region 555 Main Street Winkler MB R6W 1C4	PH: Fax:	325-1750 325-1758	Northern Region 3rd & Ross Ave Box 2550 The Pas MB R9A 1M4	PH: Fax:	627-8307 623-1773
Park-West Region 204 - 1011 Rosser Ave Brandon MB R7A 0L5	PH: Fax:	726-6064 726-6567	Park-West Region 27 Second Ave SW Dauphin MB R7N 3E5	PH: Fax:	622-2123 622-2306	Park-West Region 201 Fourth Ave S Swan River MB R0L 1Z0	PH: Fax:	734-3436 734-5615

LIVESTOCK PRODUCTION OPERATION INFORMATION REVIEW

PURPOSE:

- To assist the Technical Review Committee in the evaluation of proposed intensive livestock operations.
- To assist with the exchange of information between the proponent, municipal council(s) and rural residents.

BACKGROUND:

- Technical Review Committees were established to provide support to local governments through a technical review of proposals for intensive livestock operations. This review is based on:
  - local and provincial land use policies
  - the Farm Practices Guidelines for various livestock commodities in Manitoba
  - environmental regulations (in particular the Manitoba Livestock Manure and Mortalities Management Regulation)
  - other provincial regulations
  - other available information as deemed appropriate by the committee.

- The Technical Review Committee consists of representation from the provincial departments of Agriculture and Food, Conservation and Intergovernmental Affairs. The Regional Director of Manitoba Agriculture and Food chairs this committee.
- The final written report will be provided to the local government agency and the proponent.

N.B.: *Copies of the Livestock Production Operation Information form with Imperial units are available from your Manitoba Agriculture and Food regional office.*

Livestock Production Operation Information

Applicant Information

- ***Name of Operation:*** _____

Corporation Name (if applicable): _____

Contact Person: _____

Mailing Address: _____

_____ Postal Code: _____

Phone Number: _____ Fax No.: _____

- ***Design Consultant / Advisor:*** _____

Company Name: _____

Contact Person: _____

Mailing Address: _____

Postal Code: _____

Phone Number: _____ Fax No.: _____

For Office Use Only

Review Requested by: _____

Date of Receipt _____

Confirmation of Receipt Sent _____

Description of Operation

- Operation Location: R.M. of _____ Legal Desc. _____
- Type of Housing: Confinement _____ Outdoor _____
- Building Sizes: _____
- Are building plans available: Yes ___ No ___ Included _____
- Operation: New _____ Expansion _____ Remodel _____

	Type of Operation	*Existing Number*	*Proposed Number*	*Annual Continement Period (Days)*
Dairy	Cows - Milking Cows			
Beef	Cows - Cow-Calf			
	Backgrounder			
	Summer pasture/replacement heifers			
	Feeder cattle			
Hogs	Sows - Farrow to Finish			
	Sows - Farrow to Weanling			
	Sows - Farrow to Nursery			
	Boars (artificial insemination units)			
	Weanlings			
	Growers/finishers			
Poultry				
Chickens	Broilers			
	Roasters			
	Layers			
	Pullets			
Turkeys	Broiler			
	Heavy toms			
	Heavy hens			
Other Livestock	Type:			
	Type:			

- If any of these operations are at a location other than that indicated above, please indicate the R.M. and the legal description: _____

Manure Storage & Handling

- Manure Type: Solid _____ Liquid _____
- Storage Systems: Enclosed Pits _____ Earthen _____ Open Top Tanks _____
  Daily Scrape _____ Manure Pack _____ Open Lot _____
- Disposal Method: Broadcast _____
  Broadcast & Incorporation Within 48 Hours _____
  Injection _____ Sprinkler _____
- Total Storage Capacity: Liquid Volume[1] (m^3) _____ Solids (☐ Tons or ☐ m^3) _____
  (see following pages for calculations for capacity)
- Land Used for Disposal:

Legal Description	*Owned or Leased (O or L)*	*Acres Available for Spreading*	*Expected Application Rate (Tons or Gallons/Acre)*	*Type of Crop Anticipated to be Grown*

- Time of year for spreading: Spring ___; Summer ____; Fall ____; Winter ____
- For operations in excess of 400 animal units, attach a copy of your anticipated manure management plan (you can use Manure Management Plan registration form issued by Manitoba Conservation)

[1] 1 m^3 = 1,000 litres

Odour Control Measures

Manure Additives _____ Product Name _____

Feed Additives _____ Product Name _____

Straw Covering _____ Shelterbelt Planting _____

Other (specify) _____

Manure Storage Calculations

Species	*Type of Operation*	*A Storage Volume*			*B Confinement Period (Days)*	*C # of Units*	*Total Storage Volume*
DAIRY	Milking Cows, including heifers	m^3/day/cow (Daily Volume)			Number of Days	Number of Cows	Total Volume (A x B x C)
		Semi-Solid	Solid	Liquid			
	- Free Stall	0.097	0.066	0.031			
	- Tie Stall	0.100	0.069	0.031			
	- Loose Housing		0.075	0.012			
BEEF	Cow-Calf	m^3/day/cow (Daily Volume)			Number of Days	Number of Cows	Total Volume (A x B x C)
		Bedding	No Bedding				
		0.034	0.028				
BEEF	Feeders	m^3/day/feeder (Daily Volume)			Number of Days	Number of Feeders	Total Volume (A x B x C)
		Bedding	No Bedding				
	Backgrounder	0.0186	0.0155				
	Summer pasture	0.024	0.020				
	Feedlot cattle	0.0311	0.0269				

Species	*Type of Operation*	*A* *Storage Volume*		*B* *Confinement Period (Days)*	*C* *# of Units*	*Total Storage Volume*
HOGS		m^3/day/sow (Daily Volume) Solid	Liquid	Number of Days	Number of Sows	Total Volume (A x B x C)
	Sows - farrow to finish		0.063			
	Sows - farrow to wean		0.023			
	Sows - farrow to nurse		0.019			
HOGS		m^3/day/pig (Daily Volume) Solid	Liquid	Number of Days	Number of Pigs	Total Volume (A x B x C)
	Weanling		0.0024			
	Feeders- wet-dry feeders		0.0057			
	Feeders- dry feeders		0.0071			

POULTRY		*A* m^3/year/birdspace	*B* No. of Birds	*Total Volume (A x B)*
Chickens	Broiler - Floor	0.0348		
	Roaster	0.0328		
	Layers - cage	0.0660		
	Layers - floor	0.0478		
	Pullets - cage	0.0200		
	Pullets - floor	0.0213		
Turkeys	Broiler – floor	0.0800		
	Heavy toms - floor	0.1580		
	Heavy hens - floor	0.0940		

Site Issues

- No. of residences within a one mile radius: _____

	Residence #1	***Residence #2***	***Residence #3***
Name			
Legal Description			
Type & Size of Livestock Operation(s)			
Approx. Distance from Proposed Operation			

- No. of residences from 1 mile - 2 miles from proposed operation: _____

	Residence #4	***Residence #5***	***Residence #6***
Name			
Legal Description			
Type & Size of Livestock Operation(s)			
Approx. Distance from Proposed Operation			

	Residence #7	***Residence #8***	***Residence #9***
Name			
Legal Description			
Type & Size of Livestock Operation(s)			
Approx. Distance from Proposed Operation			

- Attach list of additional residences if required.

- Other adjacent uses: (example - Vacation Farm, Golf Course)

  Name _____

  Legal description _____

  Description of adjacent use _____

  Approx. distance from proponent's operation _____

- Distance to nearest residential, recreation, or commercial area (specify) _____

  _____

- Distance to known drains, streams, creeks, rivers (specify) _____

  _____

- Will livestock have direct access to watercourse: Yes ____ No ____

- Water Source for Operation: Pipeline ___ River ___ Lake ___
  Sandpoint ___ Dugout ___ (Dugout dimensions ___x___x___)
  Drilled Well ___ Shallow Dug Well ___

  Location of existing well or springs _____

  Expected Water Usage: Maximum daily use: _____ Annual use: _____
  (specify: imp. gal./min. ☐, US gal./min. ☐ or Litres/Sec. ☐)

  Is a water rights licence required ? Yes ___ (Indicate date your application was submitted_____)
  No ___

  Indicate the location of known bedrock outcrops, sinkholes, gravel pits, quarries on the attached maps

  Results from test boring or pits – attach logs to application _____

- Describe primary site access route to nearest municipal road, provincial road or PTH

  _____

  _____

- Other information (e.g. flooding problems, other geological or groundwater information):

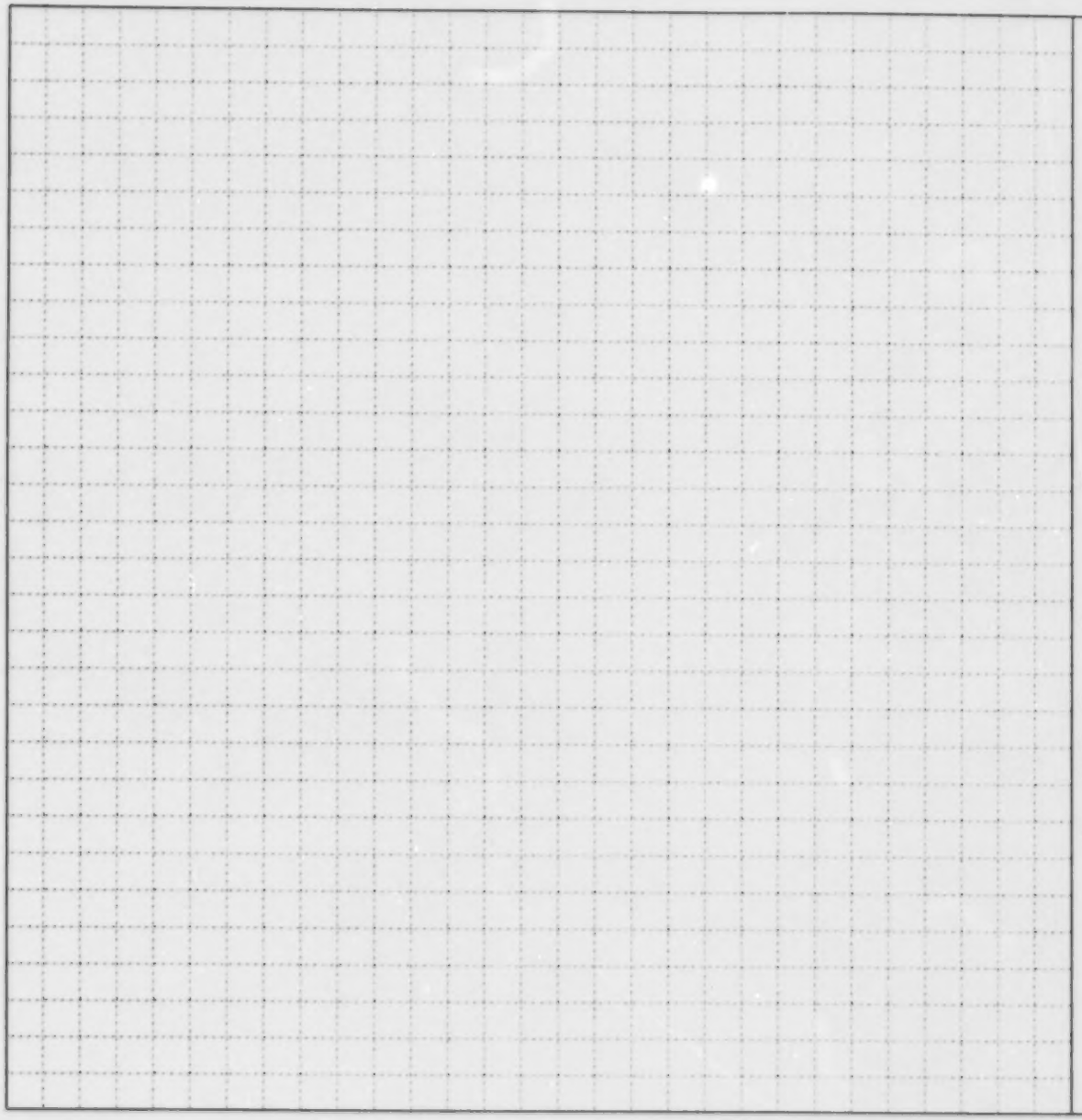
  _____

  _____

  _____

DEAD ANIMAL DISPOSAL

- Type of disposal: Rendering ____ Burial _____ Incineration ____
  Composting _____ Temporary Storage _____



YARD SITE PLAN

1. Indicate dimensions and distances for existing and proposed structures and facilities.
2. Indicate dwellings, shelterbelts, manure storage, water source locations, drainage patterns, water courses.
3. Indicate approximate distances between items.

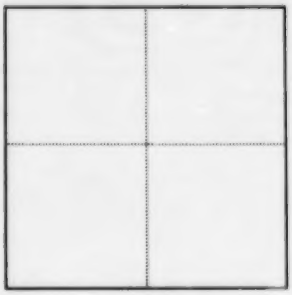
Suggested scale:

one square = 15 metres OR
one square = 50 feet

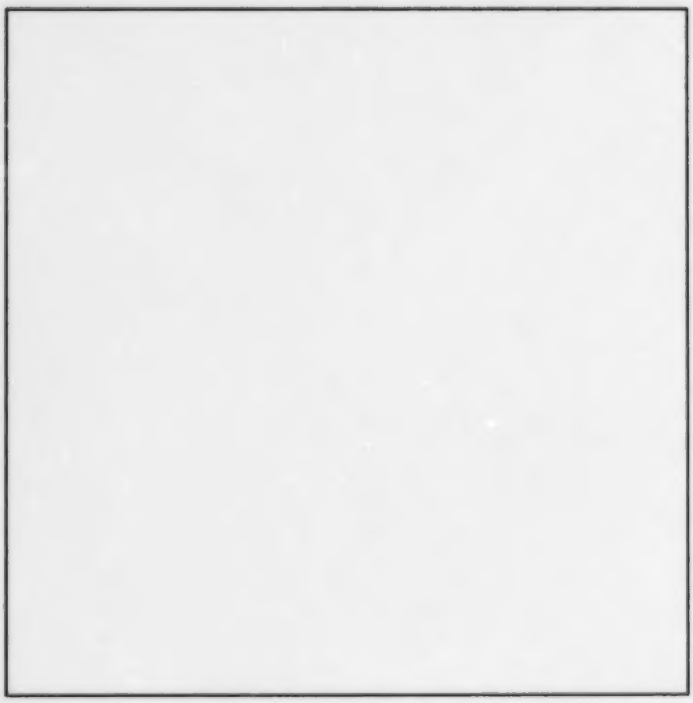
Please indicate your scale.

YARD SITE PLAN – for quarter-section

1. Provide an arrow to indicate North.
2. Indicate property dimensions.
2. Show buildings, manure storage structures, water source locations, drainage courses.
4. Indicate distances of above items from property lines.
5. Use template below or attach your own drawing.



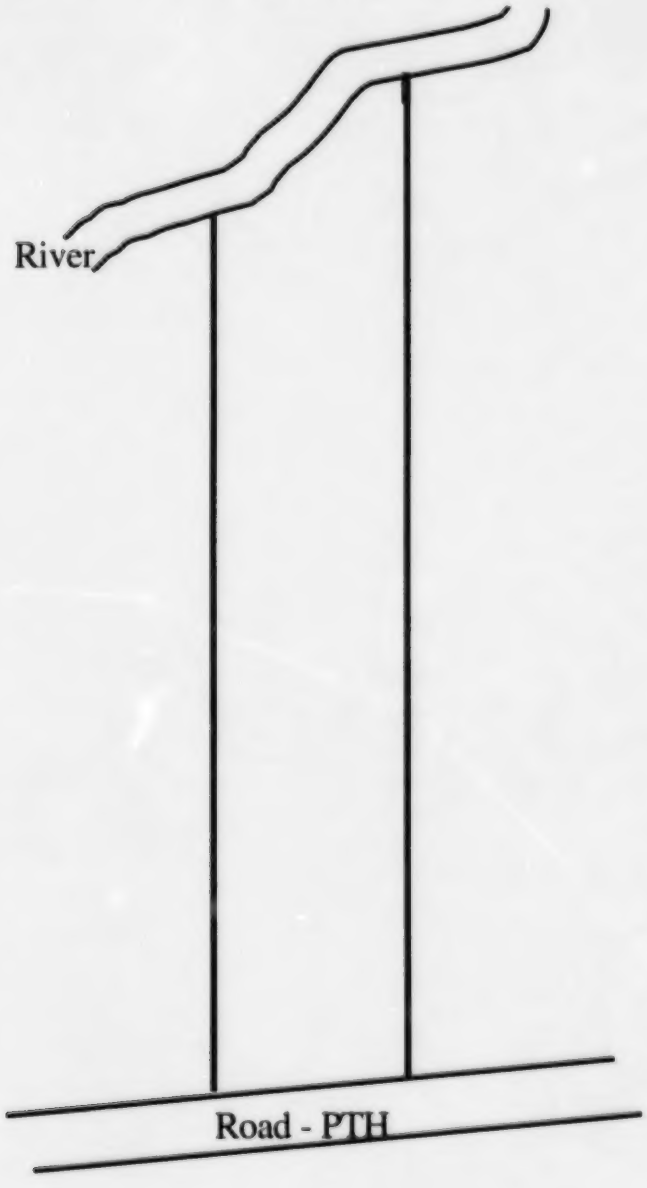
Locate the quarter-section use to locate the yard by checking off the respective quarter above.

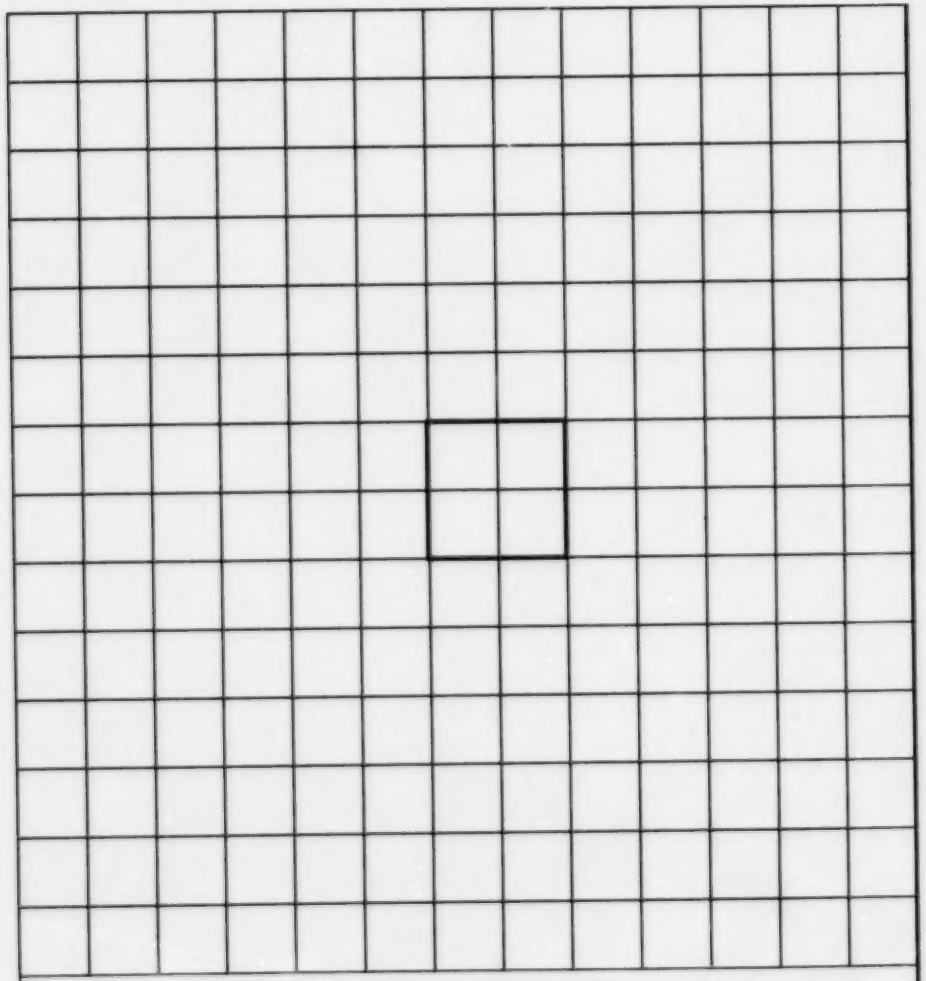


1/4 Section Drawing

YARD SITE PLAN – for river lot

1. Provide an arrow to indicate North.
2. Indicate property dimensions.
3. Show buildings, manure storage structures, water source locations, drainage courses.
4. Indicate distances of above items from property lines.
5. Use template below or attach your own drawing.





1. Locate your operation within the centre section.
2. Using a letter code, indicate location of manure disposal sites.
3. Using a number code, indicate neighbours of facility and spreading sites.
4. Indicate all watercourses and drains.
5. Indicate municipal and provincial roads, railways, pipelines, etc.

NOTE: **Use template above, or attach copy of land ownership maps, clearly indicating disposal areas with shading or hatching.**

GENERAL INFORMATION MAP

NEIGHBOURS

- designate with a number on the map and list name with corresponding number below

#	*Name*
1	
2	
3	
4	
5	
6	
7	
8	

MANURE DISPOSAL SITES

- designate with letters on the map and list below the legal description of disposal sites

	Legal Description
A	
B	
C	
D	
E	
F	
G	
H	

DEVELOPMENT OF THE ANIMAL UNIT

BACKGROUND

The spreading of livestock manure on farm land presents an opportunity to recycle organic material and reduce dependence on inorganic fertilizers. While livestock manure may be highly desirable as a fertilizer and a soil conditioner, too much of a "good thing" must be avoided in order to prevent excessive build-up of elements like nitrogen and phosphorus in the soil. To equate livestock numbers with nitrogen production, the concept of a Livestock Waste Unit was developed in the 1960s and perhaps earlier in the U.S. Reasoning that corn required 150-170 lb (68-77 kg) of nitrogen per acre to maximize production, a Livestock Waste Unit was determined as the number of animals required to produce 73 kg of nitrogen annually.

Although storage and spreading losses need to be determined to calculate the amount of nitrogen actually delivered for plant use, the Livestock Waste Unit remains as a measure of nitrogen production for each species of animal. Over time the efficiency of animals has improved due to both genetic and nutritional advances. Recalculation of nitrogen production and hence Livestock Waste Units was therefore warranted. In order to avoid confusion between the revised values and the old Livestock Waste Units previously used in Manitoba, the values developed in 1994 were referred to as "Animal Units."

In 1998, Alberta Agriculture, Food and Rural Development, Saskatchewan Agriculture and Food and Manitoba Agriculture and Food jointly adopted this approach, with the objective of harmonizing our description of livestock operation categories. Within the scope of this standardization exercise, animal units factors were revised and adopted for a wide variety of livestock species. Estimates for manure production and nitrogen content for livestock species were principally based on the standard ASAED384.1 "Manure Production and Characteristics" of the *ASAE Standards 1996 – Standards Engineering Practices Data*. In few instances, manure production data were modified to account for particular management practices such as limit feeding. Note once again that, by definition, animal unit refers to the number of animals required to excrete a total of 73 kg of nitrogen in a 12-month period.

The data presented in the following table are an excerpt from the standardized animal unit factors and equivalents developed for the three Prairie provinces in 1998. Animal unit factors for other species can be obtained from your regional livestock specialists and agricultural engineers with Manitoba Agriculture and Food.

ANIMAL UNIT SUMMARY TABLE

	A.U. Produced By One Livestock	Livestock Producing One A.U.
Dairy		
Milking cows, including associated livestock	2.000	0.5
Beef		
Beef cows, including associated livestock	1.250	0.8
Backgrounder	0.500	2
Summer pasture/replacement heifers	0.625	1.6
Feeder cattle	0.769	1.3
Hogs		
Sows, farrow to finish	1.250	0.8
Sows, farrow to weanling	0.313	3.2
Sows, farrow to nursery	0.250	4
Weanlings	0.033	30
Growers/finishers	0.143	7
Boars (artificial insemination operations)	0.200	5
Chickens		
Broilers	0.0050	200
Roasters	0.0100	100
Layers	0.0083	120
Pullets	0.0033	300
Broiler breeder pullets	0.0033	300
Broiler breeder hens	0.0100	100
Turkeys		
Broilers	0.010	100
Heavy toms	0.020	50
Heavy hens	0.010	100
Horses		
Mares, including associated livestock	1.333	0.75
Sheep		
Ewes, including associated livestock	0.200	5
Feeder lambs	0.063	16

Other livestock or operation type - please inquire of your regional agricultural engineer or livestock specialist

ANNUAL MANURE PRODUCTION RATES AND CHARACTERISTICS (PER BIRD PLACE)

Bird		Manure Production[1]		Nutrient Production (kg)		
Type	Weight (kg) at end of housing period[1]	kg	M^3	N^2	P^3	K^3
Chicken						
Broilers	1.7 - 2.0	19.8	0.020	0.44	.11	.19
Roasters	2.3 - 2.7	20.8	0.021	0.69	.19	.26
Layers	1.7 - 1.8	47.3	0.047	0.73	.17	.24
Pullets	1.28 - 1.35	14.0	0.014	0.24	.06	.08
Broiler Breeder Pullets	1.8 - 2.5	17.7	0.018	0.25	.08	.10
Broiler Breeder Hens	3.1 - 5.0	52.0	0.052	0.75	.23	.34
Turkey						
Broilers	4.5 - 6.2	72.8	0.073	0.60	.20	.23
Heavy Toms	9.8 - 13.5	119.6	0.120	1.04	.32	.38
Heavy Hens	6.2 - 9.8	104.0	0.104	0.61	.19	.22

[1] values for fresh manure (as excreted), with a density of approximately 1,000 kg/m^3; from Environmental Guidelines for Poultry Producers in British Columbia.

[2] From Appendix I.

[3] Based on consumption figures in Appendix D, Typical Ration Content and Excretion Values of S.E. Barrington in Proceedings of the National Workshop on Land Application of Animal Manure.

REFERENCES

1) Ministry of Agriculture and Food, Ministry of the Environment, Ministry of Housing. 1976. Agricultural Code of Practice, Province of Ontario.

2) Barrington, S.F. 1991. Characteristics of Livestock Manure. Proceeding of the National Workshop on Land Application of Animal Manure, Canadian Agricultural Research Council.

3) Van Kleek, R. 1997 Environmental Guidelines for Poultry Producers in British Columbia. Ministry of Agriculture, Fisheries and Food, Province of British Columbia.

4) Alberta Environment/Agriculture. 1982. Confinement Livestock Facilities Waste Management. Code of Practice, Province of Alberta.

5) Saskatchewan Agriculture and Food. 1991. Intensive Livestock Operations Guide of Recommended Practice. Province of Saskatchewan.

6) Midwest Plan Service. 1993. Livestock Waste Facilities Handbook, MWPS - 18.

7) ASAE Standards. 1996. Manure Production and Characteristics, ASAE Data: ASAE D384.1, American Society of Agricultural Engineers, 1992.

8) Leeson, S. and Summers, J.D. 1991. Commercial Poultry Production.

9) Leeson, S. and Summers, J.D. 1985. Poultry Nutrition Handbook.

10) Sell, J.L. 1993. Turkey World.